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THE

SURGEON-DENTIST'S

ANATOMICAL

AND

PHYSIOLOGICAL

MANUAL.

BY G. WAITE,

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Philadelphia:

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TO THE MEMORY

OF THE LATE

JOHN WAITE, ESQ.

SURGEON-DENTIST,

WHOSE ABILITIES RAISED HIM TO THE HIGHEST

POSSIBLE RANK IN HIS PROFESSION,

AND

WHOSE PRIVATE CHARACTER GAINED HIM THE ESTEEM

OF ALL WHO KNEW HIM,

This Book

IS DEDICATED BY

HIS SON AND SUCCESSOR,

GEO. WAITE.

PREFACE.

It is the Author's wish, in the present publication, not only to point out a system of study necessary to be pursued before any one can obtain a correct knowledge of the Teeth, but to shew that there are so many physiological points connected with them, that a knowledge of their structure and diseases was only acquired by investigations made by eminent physiologists.

As many diseases incident to them are not only abstruse but almost incomprehensible, and minutiæ connected with them have baffled the ingenuity of very eminent men, it is much to be regretted that greater pains are not ta-

ken by those who make them their principal object, to obtain a correct knowledge of anatomical points connected with them.

As the Teeth form a distinct department of the medical profession, Surgeons generally omit paying that attention to them which many interesting and useful facts connected with them appear to demand; and thus it will be perceived, that as Dentists of the present day have but a slight knowledge of anatomy, little progress is made in their physiology and pathology.

As every part of anatomy is in some measure connected with the Teeth, the Author has endeavoured to give the doctrines of the various divisions, each in a systematic order. But here a difficulty has arisen; and in treating on each doctrine, many parts of anatomy, both simple and interesting, but at the same time useful in acquiring an idea of the parts considered, have presented themselves; and

not wishing to omit these, we have brought them in as notes, trusting that the useful knowledge they will be found to contain, and the distinguished authors from which some have been selected, will additionally heighten the work in public estimation.

As the growth and structure of the Teeth cannot be at all understood without a previous knowledge of Osteology, it will be found herein explained, with points connected with it, as is usually taught in anatomical Schools, and laid down by most authors who treat on the subject; and although muscles are not in immediate contact with the Teeth, yet they raise and depress the lips and lower jaw, and thus it herein becomes our duty to explain those which are concerned in their motions, &c.

In describing the arteries, great care has been taken to be as minute as possible; and in order to give our readers, if not well vers-

ed in Anatomy, some idea from whence they originate, we have traced down the principal trunks as far as the Aorta.

And as sympathetic pains are often felt along the course of nerves connected with the Teeth, and have been mistaken for rheumatism, tic doloureux, &c. great care has been taken to describe the filaments of nerves connected with branches of the Pes Anserinus, and in such a manner as to make the reader comprehend the parts in which pain may be felt by persons suffering from Odontalgy.*

There being an absorption generally going on in parts connected with the Teeth, as well as a deposition, the nature of the absorbent vessels will be found herein explained, as likewise their offices. Although the Author wishes his work to be found generally useful, it

* Ὀδὠς, dens, et ἀλγος, dolor.

would not be systematic to go too deep into different theories, or lead a dentist beyond his depth; but those who have paid attention to the nature of the Teeth, must be aware of the impossibility to draw a conclusion as to their vascularity, or the non-existence of vessels in the bony part, without a knowledge of the doctrines which will be found herein laid down.

After the different parts of Anatomy have been explained, the teeth will be found given, with the successive changes they undergo from the fœtus towards old age; and these, upon inquiry, will be found as wonderful and admirable as any to be met with in the animal œconomy.

Lastly, the process of Dentition, the growth of Teeth of different Mammalia, and likewise the Comparative Anatomy of the Mouth, will be found given, the last, with a few excep-

tions, generally abridged from the immortal works of Cuvier and Buffon.

The important diseases connected with parts considered, such as diseases of the Antrum Highmorianum, Neuralgia, and a dangerous disease brought on by transplanting Teeth, will be found mentioned in the notes. The Author likewise trusts, that almost every physiological point connected with the Teeth will be found explained: and should the work meet with that favourable reception which it is hoped from it's utility it will do, it will be a stimulus for double exertion at a subsequent time.

The Author having devoted a considerable time to the study of the Teeth, and having, before he was acquainted with Anatomy, found many circumstances connected with them wholly inexplicable to him, most strongly recommends an anatomical knowledge to those who make them their principal pursuit;

and furthermore, he is convinced, that the opinion of a man on their Pathology ought to be set at little value whose theories are not founded on a physiological basis. Without such previous knowledge, it will be impossible for a Dentist to account for symptoms which manifest themselves; and as the late Mr. J. Hunter justly observes, "he must retain many "vulgar errors imbibed by conversing with "ignorant people, or by reading books in "which the anatomy and physiology of the "Teeth are treated without a sufficient know-"ledge of the subject."

Moreover, if a Dentist wishes to discharge that duty, owing to the emolument he receives from those who consult him, he must study the laws of nature, and become acquainted with facts connected with the Teeth. There is a conscientious mode of practice that honourable and aspiring men ought always to pursue, and such as will never fail to gain es-

teem and reputation; and while empiricism and mysterious practices are scorned at by learned men, true science will every where be found pre-eminently esteemed.

ANATOMY.

PART FIRST.

OF ANATOMY IN GENERAL.

Anatomy is a science which teaches us the different parts of the human body.

The parts are either solid or fluid.

The Solids are—

1st. Bones.*
2d. Cartilages.
3d. Ligaments.
4th. Muscles.
5th. Membranes.
6th. Viscera.
7th. Vessels.
8th. Glands.
9th. Fat and Marrow.
10th. Nerves.

* The doctrine of the growth of bones is termed Osteogeny, from the Greek words Οσεον *Os*, et γίνομαι *gingo*.
Of Adult bones—Osteology, from Οσεον *Os*, et λόγος *sermo*.
Of Muscles—Myology, from Μυὼν *musculus*, et λόγος.
Of the Viscera—Splanchnology, from Σπλάγχνον *viscus* et λόγος.
Of the Vessels—Angiology, from Αγγος *vas*, et λόγος.
Of the Glands—Adenology, from Αδὴν *glandula* et λόγος.
Of the Nerves—Neurology, from Νεῦρον *nervus*, et λόγος.

The Fluids of the human body, are the various liquors, secreted from it by peculiar glands:—

1. Ear-wax—in the Ears.
2. Tears—in the Lacrymal gland.
3. Spittle—in the Salivary glands of the Mouth.
4. Mucus—In the Mucous glands of the Nose and Mouth.
5. Gastric juice—in the Stomach.
6. Bile—in the Liver.
7. Pancreatic juice—in the Pancreas.
8. Urine—in the kidneys.
9. Semen—in the testicles.
10. Fat—in the Adipose membrane.
11. Synovia—in the joints.
12. Milk—in the breasts.
13. Perspirable Matter—in the skin.

THE

FORMATION AND GROWTH

OF

BONES.

The bones are the most hard, compact, flexible parts of the body. "They are framed as "a basis for the whole system, fitted to sup- "port, defend, and contain the more delicate "and noble organs. They are the most per- "manent and unchangeable parts of all the "body. We see them exposed to the seasons, "without suffering the smallest change; re- "maining for ages the memorials of the dead; "the evidence of a former race of men, or of "animals, which have ceased to exist since the "last great revolution of our globe; the proofs "of such changes on our globe, as we cannot "trace but by these uncertain marks. Thus "we are apt to conceive, that even in the living "body, bones are hardly organized, scarcely "partaking of life, not subject, like the soft

"parts, to disease and death: but minute ana-
"tomy, the most pleasing part of our science,
"unfolds and explains to us the internal struc-
"ture of the bones: shows their myriads of
"vessels, and proves them to be as full of
"blood as the most succulent and fleshy parts;
"having, like them, their periods of growth
"and decay; more liable to accidents, and as
"subject to internal disease."*

Bones, like all other parts where large vessels do not enter, are generally of a white colour; only in a living creature they are bluish, owing to the blood in the small vessels under their surface. The less, therefore, and fewer the vessels are, and the thicker and firmer the bony surface covering the vessels is, the whiter consequently are the bones. Hence the bones of adults are whiter than those of children; and in either young or old, the white colour of different bones, or of the several parts of the same bone, is always in proportion to their vascularity and solidity; these are circumstances which ought to be regarded by surgeons, when they are to judge of the condition of bones laid bare.

Bones are composed of Lamellæ, or Plates,

* The Anatomy of the Human Body, by Mr. J. Bell.

which are formed of fibres running longitudinally, or in a radiated manner, according to the natural figure of the bone.

The Plates of bone are originally formed by the vessels of the Periosteum Externum and Internum, or Membrana Medullaris, and not from layers detached from the external Periosteum.

The plates are connected by fibres, which some have considered as Claviculi and Nails, and called perpendicular, oblique, &c. according to their different directions.

The outer plates of bones are firmly compacted, so as to appear like one solid substance.

The inner parts of bones in general, whether long, round, or flat, have their plates, or threads, running in various directions, intersecting each other, and forming the cancelli, or spongy substance of the bones; the cancelli every where communicating with each other.

The Cancelli, in the middle of long bones, are fibrous, and form the reticular substance which divides the bone into large cells.

Towards the extremities of long bones, the cancelli are lamellated, and much more numerous than in their middle.

Cancelli of a similar nature to those of the

long bones, are also placed between the tables of flat and the inner parts of round bones.

In some of the broad bones, however, as the Scapula, the solid parts are so much compressed as to leave little room for Cancelli.

On the contrary, in the middle of the long bones, as the Os humeri, the cavities are so large as to give the bone the appearance of a hollow cylinder. In some of the largest of the long bones, as the Os femoris, their solid sides near their middle are remarkably thick, and there the Cancelli are scarcely perceptible; while, at their extremities, their sides are scarcely thicker than writing paper, and their cancelli are so numerous as to occupy the whole space between their sides.

The Cancelli of bones are formed by the internal plates passing inwards, and decussating each other; and in the long bones, the sides of the bone, in consequence of sending off the cancelli, become gradually thinner towards the extremities, while the cancelli in proportion become more numerous.

The Cancelli, though extremely minute, exist in the most solid parts of bone, as can be seen by exposure to heat, or in bones enlarged by disease. In either of these cases, small

cells may be observed, and are distinguishable from the canals containing the vessels, the former being irregular, the latter cylindrical.

The Cancelli support the membranes containing the marrow, as the Cellular Substance does the fat, and prevent one part of the column of marrow from gravitating upon another, in the various positions of the body. They also furnish a wider surface for the dispersion of the arteries which secrete the marrow.

Near the middle of most of the bones, especially the long ones, there is a slanting canal for the passage of the principal Medullary vessels.

The principal vessels pass into the Cancelli, internal membranes, and marrow; and return to the solid substance of the bone, where they meet those sent inwards from the periosteum.

After a successful injection, the arteries may be traced to the Cancelli; but the clearest demonstration of the intimate distribution of these small arteries, is to observe the effect of such a tinging substance as can retain it's colour when swallowed, digested, and mixed with the blood of any living animal, and at the same time has particles small enough to be conveyed into the vessels of the bones, such as

madder root. It was discovered by chance, that animals fed on the refuse of dyers' vats, received so much of the colouring matter into the system, that the bones were tinged by the madder to a deep red, while the soft parts were unchanged, no tint being perceptible in any other part. It was easy to distinguish by the microscope, that such colour was mixed with the bony matter, but did not remain in the vessels of the bone, which, like those of all the body, had no tinge of red.

When madder is given to animals, withheld for some time, and then given again, the colour appears in their bones, is removed, and appears again, with such a sudden change as proves the rapidity of deposition or absorption exceeding all likelihood or belief. All the bones are tinged in twenty-four hours, and in two or three days their colour is very deep; and if the madder be left off but for a few days, the red colour is entirely removed.

The bones of a living animal are so insensible, that they can be cut, rasped, or burnt, without putting the creature to pain; and the nerves distributed in their substance cannot be shown by dissection, by which it might be inferred that they have none distributed to

them: but the general tenor of nature, which bestows nerves to all other parts, should prevent us drawing such a conclusion; and if sensibility is a sure proof of nerves entering the composition of any part, as it is generally allowed to be, the exquisite sensibility of bones in some of their diseases, proves that they are amply supplied with them.

From what has been said of the vessels of bones, it is evident that there is a constant circulation of fluids in every part of them, and that there is a perpetual waste and renewal of the particles which compose the solid fibres of bone, as well as of other parts of the body; the addition from the fluids exceeding the waste during the growth of the bones; the renewal and waste keeping pretty near par in adult middle age; and the waste exceeding the supply from the liquors in old age, as is demonstrable from their weight: for each bone increases in weight as a person advances to maturity, continues of nearly the same weight till old age begins, and then gets lighter. The specific gravity of the solid sides, on the contrary, increases by age; for then they are more compact, hard, and dense. In consequence of this, the bones of old people are thinner and

firmer in their sides, and have larger cavities than those of young persons.

In the human fœtus, and in other animals, before birth, we find cartilages instead of bones. The whole fœtus appears to the eye a mere jelly, and the cartilages are so flexible, that a long bone can be bent into a complete ring.

The first mark of ossification is an artery, which is seen running into the centre of the cartilage in which the bone is to be formed. Other arteries soon appear, overtake the first, mix with it, and form a net-work of vessels; then a centre of ossification begins, stretching its rays according to the length of the bone, and the cartilage begins to grow opaque, yellow, and brittle; it will no longer bend, and the small nucleus of ossification is felt in the centre of the bone, and when touched by a sharp point is of a gritty feel. Other points of ossification are successively formed: always the ossification is foretold by the spreading of the artery and the arrival of red blood. Every point of ossification has its arteries: each ossifying nucleus has little dependence on the cartilage on which it is formed; and if the cartilage is cut into thin slices, and steeped

in water till its arteries rot, the nucleus of ossification drops spontaneously from the cartilage, which is left like a ring, with a smooth regular hole where the bone originally was. The redness of each bone is less when ossification is advanced, and when the bony matter accumulates in the arteries, it is no longer seen; the centre of the bone becomes whiter, and the colour removes towards its ends. The bones of the cranium are formed between membranes, and are more compact than the long bones: and the teeth are likewise not formed near cartilage, but on a vascular pulp, which we shall hereafter describe.

The phenomena displayed in fractured bones have greatly tended towards an accurate knowledge of their formation, and the exudation from their broken surface, suggested the manner in which they might be formed. The experiments made by Du Hammel threw great light on the subject; and it is now proved that by the action of the arteries all parts of the human body, fluids as well as solids, are formed. This was the opinion of De Heide, a celebrated surgeon of Amsterdam. At different times he broke the bones of animals, and after each experiment found a great effusion of

blood among the muscles and round the broken bones, and tracing this through its progress, he found it became gradually white and cartilaginous, then harden into common bone.

The formation and growth of bone is now understood by anatomical professors in all parts of Europe. The diseases of bones are so common, and sometimes so tedious and painful, that all surgeons ought to have a thorough knowledge of facts relating to them.

The bone composing the Teeth is much harder than common bone, and not so liable to irritation, although the pathology of many diseases incident to them is very complicated; and it is impossible for any Dentist to have a correct knowledge of their structure, without being well acquainted with their formation and growth.

THE PERIOSTEUM

Is a membrane furnishing a general covering to bones.

Like most other membranes, it may be divided into layers. Fibres are perceptible upon minute examination, attaching it to the bones, and those fibres have been found to be small arteries entering them.

In some places it is perforated by muscles, ligaments, &c. and at the joints it leaves the bones to form a covering to the Capsular ligament.

The nerves of the Periosteum are very minute, but its sensibility in the diseased state clearly shows that they exist. Its uses are, to strengthen the conjunction of the bones with their epiphyses, ligaments, and cartilages; to prevent the effects of friction between the muscles and the bones; to keep in due order, and to support the vessels passing into the bones; to limit their increase, and check their overgrowth, and to give attachment to muscles.

THE PERIOSTEUM INTERNUM,

OR

MEMBRANA MEDULLARIS.

As well as being covered externally, bones are lined within by a membrane, called, Periosteum Internum, or Membrana Medullaris.

This membrane has but a slight adhesion to the bone, but seems to be more intimately attached to the marrow. It is divided into many small parts, which line the different cancelli. It forms so many irregular bags, communicating with each other, and affords a large surface for the dispersion of the secretory vessels of the marrow.

OSTEOLOGY.

The Teeth are contained in the Alveoli, or sockets of the Superior and the Inferior Maxillary bones.

The Upper Jaw bones, or Ossa Maxillaria Superiora, constitute principally the shape of the middle part of the face. They form part of the orbit, a great part of the nose, and, with the palate bones, the roof of the mouth. They are hollow within, having a cavity capable of containing an ounce of fluid, and are subject to a disease which causes great deformity of the face, and frequently baffles the skill of the most enlightened men in the profession. The processes of this bone are as follow:

The nasal process, an internal ridge or spine, the orbitar process, the malar process, the alveolar process, the palatine process, and the tuberous process.

The Nasal process projects upwards, forming the side of the nose. On it's inside is a ridge, giving attachment to part of the inferior spongy bone.

The Orbitar process, or plate, projects

backwards from the Nasal process, forming the bottom of the orbit.

The Malar process is situated on the outside of the bone, and is unequal and ragged, where it contributes with the Os Malæ to form the prominence on the cheek.

The Alveolar process is of a spongy nature at the outer and under part of the bone, where the Alveoli, or sockets of the teeth are placed.

The Tuberous process is situated behind the last molar tooth.

The Depressions are—

One behind the Malar process, where the under end of the Temporal muscle plays.

A depression at the under and fore part of the Malar process, where the muscles which raise the upper lip and corner of the mouth originate, and where a branch of the fifth pair of nerves is lodged, and commonly a large portion of fat.

An arch formed by the Palate plate above and below, for enlarging the cavities of the Nose and Mouth.

A notch forming the under and fore part of the nostril, to the edge of which, and to the corresponding one of the nasal process, the cartilages of the side of the nose are connected.

The Alveoli,* or Sockets for the teeth, porous for the firmer adhesion of the reflected membrane of the gums, and for the transmission of blood vessels into the substance of the bones; the number of sockets corresponding to the Fangs of the teeth.

The Lacrymal fossa, which with that part of the Os Unguis forms a passage for the Lacrymal duct into the nose.

A Canal in the Orbitar plate, terminating anteriorly in the Foramen Infra Orbitarium, through which the Infra Orbitar twig of the Superior Maxillary branch of the par trigeminum passes along with a branch of the Internal Maxillary artery to the face.

The Foramen Incisivum, or Palatinum Anticum, situated behind the front Incisor teeth. It is a foramen common to both bones. Through

* The growth of the Alveoli, their adaptation to the size of the secondary teeth, and their absorption towards old age, exhibit a succession of very beautiful and curious phenomena.

it pass small arteries and veins, and the termination of the Sphœna Palatine branch of the Superior Maxillary nerve.

The foramen Pterygo Palatinum, or Palatinum Posticum, is common to this and to the Palate bone; it is situated on the inner side of the back part of the tuberous process.* The Pterygo Palatine branch of the Superior Maxillary nerve passes through this foramen, along with small arteries and veins.

The Antrum Highmorianum, or Sinus Maxillaris, is situated beneath the orbitar plate, and above the large Molar teeth.

Small prominences may often be observed in this cavity, containing the points of the roots of the teeth; and the partition between them is generally not very thick.

The opening of the sinus is large in the separated Maxillary bone; but, in the connected state, it is so covered by the Inferior Turbinated bone and membranes, that it will only admit an instrument about the size of a crow-quill.†

* The Spheno Maxillare fissure is likewise common to this bone and the Sphenoid. It is situated in the orbit.

† This cavity is liable to a variety of diseases. Some-

Connections.

This bone is connected by the transverse Suture to the Frontal Bone; to the Os Ungius

times its membranous lining inflames, and secretes an extraordinary quantity of mucus, or pus; at other times, in consequence of inflammation, or other causes, it is the seat of various excrescences, polypi, and fungi. Even the bony parietes of the Antrum are occasionally infected with exostosis, or caries. Sometimes it contains extraneous bodies; and it is even asserted that insects may be generated there, and cause for many years very afflicting pains.

Inflammation of the membraneous lining of the Antrum, sometimes produces an extraordinary secretion of mucus within that cavity, and the collected fluid being confined, the bony parietes of the cavity become expanded in a surprising degree. "This disease," says Boyer, "is sometimes ascribed to a blow on the cheek, "to caries of the teeth, or the projection of one of their "fangs into the antrum. But, in general, the case "takes place unpreceded by any of these causes, and "without there being the least ground for suspecting "what has given rise to that disorder. It is remarked, "however, that collection of mucus within the antrums "are most frequent in young subjects; of three patients "seen by Boyer, the oldest was not more than twen-"ty."—(Traité des Mal. Chir. T. 6, p. 139.)

As Mr. Hunter has noticed, whether the obliteration of the duct, leading to the nose, be a cause, or only an effect of the disease, is not easily determined; but,

by the Lacrymal Suture; to the Os Nasi by the Lateral Nasal Suture; to the Os Malæ

from some of the symptoms, there is reason to believe it an attendant. "If it be a cause, we may suppose "that the natural mucus of these cavities accumulat-"ing, irritates, and produces inflammation for its own "exit, in the same manner as an obstruction to the "passage of the tears through the ductus ad nasum, "produces an abscess of the lachrymal sac."—(See Hunter's Natural Hist. of the Teeth, p. 171, 3rd edit.).

The most interesting example of the effects of this lodgment of mucus in the antrum, is that recorded by Dubois: a boy, between seven and eight years of age, was observed to have at the base of the ascending process of the upper jaw-bone, on the left side, a small, very hard tumor, of the size of a nut.

As it gave no pain, and did not appear to increase, his parents gave themselves no concern about it. When he was about sixteen, it increased in size, and began to be somewhat painful. Before he was eighteen, its augmentation was so considerable, that the floor of the orbit was raised up by it; the eye thrust upwards, the palpebræ very much closed, the arch of the palate pushed down in the form of a tumour, and the nostril almost effaced. Below the orbit, the cheek made a considerable prominence, while the nose was thrown towards the opposite side of the face, and the skin at the upper part of the tumor, below the lower eyelid, was of a purple red colour, and threatened to burst. The upper lip was drawn upwards, and behind it, all the gums on the left side were observed to project

by the internal and external Orbitar Sutures; to the Ethmoid Bone by the Ethmoid Suture;

much further than those on the opposite side of the face, and at this point alone, the thinness of the bony parities of the antrum was perceptible.

The patient spoke and breathed with great difficulty; he slept uneasily, and his mastication was painful. The case was, at first, supposed by Dubois, Sabatier, Palletan, and Boyer, to be a fungus of the antrum, and an operation was considered advisable.

In proceeding to this measure, the first thing that attracted the notice of Dubois, was a sort of fluctuation in the situation of the gum, behind the upper lip; a circumstance which led him to give up the idea of the case being a fungus, though he expected that, on making an opening, merely a small quantity of ichorous matter would escape, affording no kind of information. In this place, however, he determined to make an incision, along the alveolary process, whereby a large quantity of a glutinous substance, like lymph, or what is found in cases of ranula, was discharged. A probe was now introduced, with which Dubois could feel a cavity equal in extent to the forepart of the tumour; and in moving the instrument about, with the view of learning whether any fungus was present, it struck against a hard substance, which felt like one of the incisor teeth, near the opening that had been made. Five days after this first operation, Dubois extracted two incisors and one grinder, and then removed the corresponding part of the alveolary process. As the hemorrhage was profuse, the wound was now filled

to its fellow, by the Longitudinal Palate Suture; to its fellow also, between the fore part

with dressings, which in two days came away, and enabled Dubois to see with facility all the interior of the cavity. At its upper part, he perceived a white speck, which he supposed was pus, but on touching it with a probe, it turned out to be a tooth, which was then extracted, in doing which, some force was requisite. The rest of the treatment merely consisted in injecting lotions into the cavity, and applying common dressings. In about six weeks, all the hollow disappeared, but the swelling of the cheek and palate, and the displacement of the nose still continued. In the course of another year and a half, however, every vestige of deformity was entirely removed.—(Dubois, Bulletin de la Faculté de Med. an 13, No. 8.)

Abscesses in the Antrum require a free exit for their contents; and if the surgeon neglects to procure such opening, the bones become more and more distended; and pushed out, and finally carious. When this happens, the pus makes its appearance, either towards the orbit, the alveoli, or the palate, or, as is mostly the case, towards the cheek. The matter having now made a way for its escape, the disease becomes fistulous.

In the treatment of diseases of the Antrum, the extraction of one or more teeth, and the perforation of the alveoli, being generally necessary steps, we must consider what tooth must be taken out in preference to others.

A caries, or a more continual aching of any particular tooth, ought to decide the choice. But if all the

of the nose and mouth by the mystachial suture.

teeth should be sound, which is often the case, writers direct us to tap each of them gently, and to extract that which gives most pain on this being done. When no information can be thus obtained, other circumstances ought to guide us.

All the grinding teeth, except the first, correspond with the antrum. They even sometimes extend into this cavity, and the fangs are only covered by the pituitary membrane. The bony lamella, which separates the antrum from the alveoli, is very thin towards the back part of the upper jaw. Hence, when the choice is in our power, it is best to extract the third or fourth grinder; as in this situation, the alveoli can be more easily perforated. Though, in general, the first grinder and canine tooth do not communicate with the antrum; their fangs approach the side of it, and from their socket an opening may be readily extended into that cavity.

When one or more teeth are carious, they should be removed, because they are both useless and hurtful. The matter frequently makes it's escape as soon as a tooth is extracted, in consequence of the fang having extended into the antrum; or rather, in consequence of its bringing away with it a piece of the thin partition between it and the sinus. Perhaps a discharge may follow, from the partition itself being carious. If the opening thus produced be sufficiently large to allow the matter to escape, the operation is already completed. But, as it can be easily enlarged, it ought always to be so, when there is the least suspicion of its being too

small. However, when no pus makes its appearance after a tooth is extracted; the antrum must be opened by introducing a pointed instrument in the direction of the alveoli. Some use a small trochar or awl; others a gimlet for this purpose.

The patient should sit on the ground in a strong light, resting his head on a surgeon's knee, who is to sit behind him. Immediately as the instrument has reached the cavity, it is to be withdrawn. It's entrance into the antrum is easily known, by the cessation of resistance. After the matter is discharged, surgeons advise the opening to be closed with a wooden stopper, in order to prevent the entrance of extraneous substances. The stopper is frequently to be taken out to allow the pus to escape. Sometimes the pus continues to be discharged for some time after the operation, without any change occurring, in regard to its quality or quantity. In such instances, the cure may be often accelerated by employing injections of brandy and water, lime water, or a solution of the sulphate of zinc.

Surgeons formerly treated diseases of the antrum in the most absurd and unscientific way, introducing setons through it's cavity, and even having recourse to the actual cautery. The moderns are not much inclined, however, to adopt this sort of practice.

It is now known that the detachment of a dead piece of bone, in other terms, the process of exfoliation, is nearly, if not entirely, the work of nature, in which the surgeon can act a very inferior part. Indeed he should limit his interference to preventing the lodgement of matter, maintaining strict cleanliness, and removing the dead pieces of bone as soon as they become loose. But it is to be understood, that examples occa-

sionally present themselves in which the dead portions of bone are so tedious of separation, and so wedged in the substance of the surrounding living bone, that an attempt may properly be made to cut them away.—For further particulars, see Hunter on the Teeth, p. 175. Deschamps, Traité des Maladies des Fosses Nasales et de leur Sinus. p. 231. 8vo. Par. 1804. Boyer, Traité des Maladies Chirur. t. 6. p. 145. 8vo. Paris, 1818; et Mémoires de l'Acad. de Chirur. t. 4. p. 351.

Tumours of the Antrum.—Ruysch, Boerhaave, Desault, Bordenaave, Abernethy, Cooper, and many other Surgeons, have recorded cases of Polypus, fungus, and cancerous diseases of the Antrum, and of the parietes of this cavity being affected with exostosis.

The indolence of any ordinary fleshy tumour in the Antrum, while in the incipient state, certainly tends to conceal it's existence; but such a disease rarely occurs without being accompanied by some affection of the neighbouring parts; and it's presence may generally be ascertained before it has attained such a size as to have altered the conformation of the Antrum. This information may be acquired by examining whether any of the teeth are loose, or have spontaneously fallen out; whether the alveolar process is sound, and whether any fungous excrescences have made their appearance from the sockets; whether there is any habitual bleeding from one side of the nose, any sarcomatous tumour at the side of the nostril, or towards the great angle of the eye. When the swelling has attained a certain size, the bony parities of the Antrum are always protruded outwards, unless the body of the tumour should be situated in the nostril, and only its root in the Antrum; this case is very uncommon. As soon as

a tumour is certainly known to exist in the Antrum, the front part of this cavity should be opened, without waiting till the disease makes farther progress. In a few instances, indeed, we may avail ourselves of the opening which is sometimes found in the Alveolar Process, and enlarge it sufficiently to allow the tumour to be extirpated. If the front of the Antrum be laid open, it will in general be better to cut away the disease from the interior.

A sign of an Exotosis, besides the absence of the symptoms characterizing an abscess or a sarcoma, is the thickened parietes of the Antrum forming a solid resistance; whereas in cases of mere expansion, the dimensions of the surface being increased, while it's substance is proportionably extenuated, the resistance is not considerable. When such an exostosis depends upon a particular constitutional cause, and especially one of a venereal nature, it must be attacked by remedies suited to this affection. But, when the disease resists internal remedies, and its magnitude is likely to produce an aggravation of the case, a portion of bone may be removed by the trephine, or a cutting instrument. Such operations, however, require a great deal of delicacy and prudence.—For further particulars, read Mr. B. Bell, vol. 4. New London Med. Journal, vol. 1. p. 4. Œuvres Chirurgicales de Desault, par Bichat, t. 2.

Insects in the Antrum.—It is said, that insects in this cavity sometimes make an opening into it necessary. This case, however, must be exceedingly rare; and even what we find in Authors (Pallas, de Insectis Viventibus intra Viventia) appears so little authentic, that I should hardly have mentioned the circumstance,

if there were not in a modern work, (Med. Com. vol. 1.) a fact which appears entitled to attention. Mr. Heysham, a medical practitioner at Carlisle, relates this case, in which three insects, more than an inch in length, were extracted from the Antrum.

In the 12th and 13th vol. of the Mém. de l'Acad. de Chirurgie, there are two excellent papers on diseases of the Antrum. In the thirteenth volume, a case is related in which several small whitish worms, together with a piece of fœtid fungus, were discharged from the Antrum, after an opening had been made on account of an abscess of this cavity, attended with caries (p. 381); but in this instance, the worms had probably been generated after the opening had been made in the cavity, for when they made their appearance the opening had existed nine months. Deschamps relates another case, where M. Fortassin, his colleague at la Charité, found in the Antrum of a soldier, whom he was dissecting, a worm of the Ascharis Lumbricus kind, four inches in length. (Traité des Maladies des Fosses Nasales, &c. p. 107.) Such an example is recorded in one of the volumes of the Journal de Medecine. Were a case of this description to present itself in the living subject, it would be adviseable to inject oil into the cavity of the Antrum, and then endeavour to wash out the extraneous substances by throwing into the sinus warm water, by means of a syringe.—Cooper's Surgical Dictionary.

For further information, see Précis d' Observations sur les Maladies du Sinus Maxillaire, par M. Bordenaave, in Mém. de l' Acad. Royale de Chirurgie, t. 12. edit. in 12mo. L'Encyclopedie Méthodique, Partie

Chirurgical, Art. Antre Maxillaire. Boyer, Traité des Maladies Chi. t. 6. p. 149. Désault's Parisian Chirurgical Journal, vol. 1 and 2. Medical Communications, vol. 1.

THE LOWER JAW;

OR,

OS MAXILLARE INFERIUS,

May be compared to the letter U in shape, but it's form is too well known to need much explanation. It is situated at the lower part of the face, and is divided into chin, base, angle, and ascending ramus.

The chin is the middle fore part of the bone, extending as far on each side as the mental foramina.*

The base of the Jaw is a straight and even line, terminating the outline of the face. It may be distinctly traced all along, from the first point of the chin, backwards to the angle of the Jaw.†

* The fore part of the chin in a handsome face ought to be very square.

† Fractures of the lower Jaw may be either perpendicular to it's base, oblique, or longitudinal. Cases are on record where a portion of the Alveolar process was detached from the rest of the bone. A Fracture, either

The Angle of the lower Jaw is where the base terminates, and from it the ascending ramus passes upwards, terminating in the condyle.

The Coronoid process, which is supposed to resemble a horn, projects upwards behind the last Molar teeth, is sharp at its point, and lies internally to the Zygoma: the Temporal muscle is firmly attached round it's point.

The Condyloid process is situated behind the Coronoid, having on its top an articulating head or condyle, which is received into a cavity of the Temporal bone, and attached to it by means of a capsular ligament: the communication between it and the Coronoid process is termed the Semilunar Notch.

The cervix of the lower Jaw is situated beneath the condyle, and has anteriorly a depression, into which the External Pterygoid muscle is inserted.

oblique or perpendicular to the base, may be detected by passing the finger along it. The anterior portion will be found pulled down by the muscles under the lower Jaw, and the posterior fragment will remain in situ owing to the Temporal, Masseter, and Pterygoid muscles.—For further information, see Cooper's Dictionary.

Between the Coronoid and Condyloid Process is a notch, called the Semilunar Notch.

The Alveolar Process,* corresponds to that

* The successive changes of the form of the Jaw are well worthy of notice; first, that in the child the jaw consists of two bones, which are joined together slightly in the chin. This joining, or symphysis, as it is called, is easily hurt, so that in præternatural labours it is, according to the common method of pulling by the chin, always in danger, and often broken. During childhood the processes are blunt and short, do not turn upwards with a bold and acute angle, but go off obliquely from the body of the bone. The teeth are not rooted, but sticking superficially in the alveolar process: and another set lies under them, ready to push them from the jaws.

Secondly. In youth, the alveolar process is extending, the teeth are increased in number. The coronoid and articulating processes are growing acute and large, and are set off at right angles from the bone. The teeth are now firmly rooted, for the second set has come up from the body of the jaw.

Thirdly. In manhood, the alveolar process is still more elongated, the dentes sapientiæ are added to the number of the teeth; but often by this the jaw is too full, and this last tooth coming up from the backmost point of the alveolar process of the other jaw, it sometimes happens that the jaw cannot easily close; the new tooth gives pain, it either corrodes, or it needs to be drawn.

Fourthly. In old age, the jaw once more falls flat,

of the Upper Jaw, and extends as far back as the root of the Coronoid process.

The Spinous Process is situated internally to the Foramen Maxillare Posticum, giving attachment to the Lateral Ligament.

A small tubercle behind the Symphysis, giving attachment to the Frænum Linguæ and muscles of the tongue.

The Linea Mylo Hyoidea is a line on the inside of the lateral part of the bone, giving origin to the Mylo Hyoideus muscle. A roughness internally to the angle for the attachment of the Internal Pterygoid muscle.

The Posterior Maxillary Foramen is situated on the inner side of the bone, about three quarters of an inch below the semilunar notch. It is at this Foramen that the Inferior Maxillary Branch of the Par Trigeminum and the Maxillary Vessels enter the bone, and, pass-

and shrinks, according to the judgment of the eye, to half it's size; the sockets are absorded, and conveyed away. When the chin stands forward, and in old age, the Coronoid process rises at a more acute angle from the jaw bone, and by the falling down of the alveolar process, it seems greatly increased in length.—Bell's Anatomy, vol. 1. p. 16.

ing along the canal, give dental branches upwards to the teeth.

The Mental Foramen is situated on the side of the chin, and is the exit for the remains of the Maxillary Artery and Nerve.

A small groove is seen extending from the Posterior Foramen towards the Symphysis, along which passes a small nerve to the Mylo Hyoideus.

The Condyloid Process of the Lower Jaw is attached to the Sinus Articularis of the Temporal bone by means of a Capsular ligament. Interposed between the two bones is a moveable cartilage, thick at the sides and thin in the middle, being consequently of a concave shape. It is firmly connected by Ligament to each Condyle, so as to follow it's motions, and so loosely to the temporal bone, as readily to change it's situation from the cavity to the tubercle, and to return again; while the common ligament of the Articulation affords space enough for such a change of place, backward and forward. Like other capsular ligaments, it is stronger at it's side to prevent lateral motion.

The teeth are received into the Alveoli, and the articulation is termed Gomphosis.

In a child full born, the Lower Jaw is composed of two bones, connected by a thin cartilage in the middle of the chin, which gradually ossifies, and the bones intimately unite.*

* Tous les animaux vertébrés ont deux mâchoires ; aucun n'en est dépourru, et aucun n'en a plus de deux ; elles sont dans tous placées l'une au dessus de l'autre. L'inférieure est seule mobile dans les mammifères ; la supérieure l'est plus ou moins dans la plupart des genres des autres classes.

Ces choses ne sont pas aussi constantes dans les animaux sans vertèbres. Parmi les mollusques, les céphalopades ont les deux mâchoires mobiles, situées dans l'axe du corps, et dont la position n'est point fixe par rapport au dos et au ventre. Quelques gastéropodes, comme le limaçon, n'ont qu'une mâchoire supérieure ; d'autres, comme la tritonie, en ont deux latérales ; d'autres en manquent, tout a fait, comme le buccin, etc.

Tous les acéphales, sans exception, en sont absolument dépourrus.

Une partie des vers en a de latérales, tels sont les néreides ; une autre partie en a trois, les sangsues le plus grand nombre en manque, comme les lombrics. Les crustacés en ont tous plusieurs paires de latérales.

Une moitié environ des insectes en a deux paires de latérales ce sont les gnathoptères, le névroptères, les coléoptères, les orthoptères, et les hyménoptères ; l'autre moitié, savoir, les lépidoptères, les hémiptères, les diptères, et les aptères en manque absolument.

La mâchoire inférieure de l'homme est composée de deux pièces dans le fœtus et dans l'enfance, ne presente plus, dans l'adulte, qu'un seul os, formant une lame épaisse, courbée en arc dans son milieu, et dont les extrémites sont repliées de bas en haut. Chaque moitié de cet arc est parfaitement semblable à l'autre : ce sont proprement les branches de la mâchoire, quoique l'on donne aussi ce nom à la portion montante de celle ci. Chacune de ces branches n'est jamais formée, dans les autres mammifères, que d'une seule pièce ; elles restent presque constamment distinctes dans la plupart d'entreux tels que les mahis, toutes carnassiers (les chauves souris exceptées) les rongueurs, la plupart des edentes, les ruminans ; les phoques, le dugon, parmi les amphibies, les cetacés ; et l'on y voit facilement la suture qui unit leurs extremités antérieures. Cette suture s'efface de très bonne heure dans les singes, les chauves-souris, et particulièrement les roussettes, les phatagins, parmi les edentes les elephants, chez lesquels les deux moitiés se confondent aussitôt que dans l'homme. Elles se soudent aussi de bonne heure dans les pachydermes, les solipedes, le morse ou le lamantin parmi les amphibies ; de sorte que l'on ne peut assigner de rapport physiologique entre l'un ou l'autre de ces circonstances et la forme particulière de la mâchoire inférieure.

Les branches de cette mâchoire se prolongeant en arrière, dans les oiseaux, beaucoup au de la supérieure, presente ordinairement des sutures vis a vis de la base de cette dernière mais elle n'en ont point à l'angle de de leur réunion. Leur ensemble est donc composée de trois pièces, une moyenne et deux laterales, qui alongent en arrière les branches de l'arc ou les côtes de l'angle que forment la prémière. Dans la plupart des

passeraux, dans les pies, la plupart des oiseaux de proies diurnes, on ne voit aucune trace de suture, et la mâchoire inférieure ne paroit formée que d'une pièce.

Nulle part de sa composition ne paroit aussi compliquée que dans les reptiles. Celle de la torture franche a sept pièces distinctes; une moyenne qui forme l'arc, et trois autres de chaque côté ajoutées à ses branches, dont la plus reculée s'engrène comme un coin entre les deux autres, et forme en grande partie la cavité articulaire.

Ce nombre augmente dans beaucoup de sauriens. On compte dans la mâchoire inférieure du crocodile du Nil, et dans celle du caïman jusqu'a douze pièces osseuses, dont voici la disposition. Les deux branches sont distinctes et réunies seulement par une suture; chacune est composée conséquemment de six pièces; 1°. une formant toute la portion dans laquelle les dents sont implantées; 2°. une autre doublant la face interne de la première, sans s'entendre jusqu'a son extrémité antérieure; 3°. et 4°. deux autres articulées avec les premiers, dont une inférieure se prolonge jusques à l'extrémité postérieure de chaque branche, l'autre supérieure aussi, étendue en arrière que la première, dans le crocodile du Nil, ou moins reculée qu'elle dans le caïman. La Plus grande partie de la cavité articulaire et creusée dans une cinquième pièce qui est en dedans des deux précedentes, et forme la partie interne et supérieure de la portion qui est au dela de cette cavité. Enfin une sixième pièce borde en avant et en dedans l'orifice du canal dentaire. La mâchoire inférieure des tupinambis est composée de même de douze pièces, dont deux pour les apophyses coronoides, et les dix autres analogues à celles d'écrites dans les crocodiles, excepté

celle indiquée la dernière. Nous en avons trouvé huit, ou dix dans la plupart des autres sauriens. Il y en a quatre à chaque branche, dans les orvets, dont une antérieure unie par son extrémité antérieure à sa pareille, et trois autres postérieures á la prémière. On n'en compte que quatre en tout dans les amphisbènes. Ce sont, avec les précédens les seuls ophidiens dont les branches ne soient pas séparées par devant. Dans tous les autres ou cette separation a lieu, chaque branche n'a que deux pièces distinctes ; une antériure dans laquelle les dents sont implantées et l'autre postérieure jointes toutes deux par des sutures, et dont la longueur relative varie suivant le nombre des dents.—Cuvier, Anatomie comparée, t. 3. p. 15.

MYOLOGY;

OR,

THE DOCTRINE OF THE MUSCLES.

The use of the muscles is to perform the various motions of the body.

They are divided into origin, or that extremity of the muscle, which arises from the most fixed part, and towards which contraction is made;

The belly, which swells when the muscle is in action;

The Insertion, or that extremity which is inserted into the part to be removed.*

Tendons are for the purpose of connecting muscles to bones; they have very few blood vessels, and no evident nerves.†

We shall now proceed to the muscles of the lips and the Lower Jaw.

* Muscles are divided into Rectilineal, Simple Penniform, Compound Penniform, Radiated, and Hollow, as the heart.

† Annular ligaments are to keep tendons in their proper situation.

Muscles of the Lips.

The motions of the lips strongly indicate the various passions.

Those of the upper lips are as follow:

Two on each side raising the upper lip, or levators.	Levator Labii Superioris Alæque Nasi. Levator Labii Superioris Proprius.
One on each side depressing it.	Depressor Labii Superioris Alque Nasi.

Those of the lower lip:

One on each side raising it.	Levator Labii Inferioris.
One on each side depressing it.*	Depressor Labii Inferioris.

Those of the corners of the mouth:

Three on each side raising them.†	Levator Anguli Oris. Zygomaticus Major et Minor.
One on each side depressing them.	Depressor Anguli Oris.
One on each side drawing them back.	Buccinator.
One Muscle surrounding the mouth.	Orbicularis Oris.

* As in expressing anger.

† As in laughing.

Lev. Labii Sup. Alæque Nasi. It arises by a double tendon from the nasal process of the Superior Maxillary bone, near the tendon of the Orbicularis oculi, and proceeding downwards divides into two fasciculi, one to be inserted into the Ala of the nose, another into the upper lip.

Levator Labii Superioris. It arises from the Upper Jaw, a little above the Incisor Teeth, and running downwards and inwards, is inserted into the upper lip.

Depressor Labii Sup. Alæque Nasi. It lies concealed under the former muscles, arising corresponding to the two front Incisor Teeth, and turns upwards to be inserted into the root of the nostril and upper lip.

Lev. Labii Inferioris. It arises from corresponding to the roots of the lower Incisor Teeth, and is inserted into the under lip and skin of the the chin.

Depressor Labii Inferioris. It arises from the side of the chin near the base of the Lower Jaw, and proceeding upwards and inwards, meets its fellow from the opposite side, and is inserted into the under lip.

Levator Anguli Oris. It arises from the upper jaw bone just above the root of the

Canine Tooth, or between the root of the first Molar Tooth and Infra Orbitar foramen; it proceeds downwards to the corner of the mouth, its fibres becoming blended with those of the orbicularis oris.

Zygomaticus Major. It arises from the Os Malæ near the Zygomatic suture; it is a slender muscle, running downwards and inwards towards the corner of the mouth, its fibres there becoming blended with the other muscles.

Zygomaticus Minor. This small muscle arises higher up on the cheek bone than the former, and taking a course downwards and inwards, is inserted into the angle of the mouth, its fibres being there blended with those of the other muscles. It is sometimes wanting.

Depressor Anguli Oris. It arises broad from the base of the Lower Jaw by the side of the chin, and proceeding upwards in a triangular form, is inserted into the angle of the mouth.

Buccinator. It arises from a ridge extending between the last Dens Molaris and Coronoid process of the Lower Jaw, and from the Upper Jaw between the last Molar Tooth and External Pterygoid process of the Sphenoid

bone, from the extremity of which it likewise takes an origin; then passing forwards with straight fibres is inserted into the angle of the mouth, and adheres closely to the membrane lining it.*

Orbicularis Oris. This is a Sphincter muscle surrounding the mouth; at the corners the fibres decussate each other, making it resemble two semicircular muscles. It shuts the mouth, and counteracts the other muscles inserted into it.

* The Buccinator muscle is the principal agent by which we blow wind instruments; hence it has derived its name. It presses the cheek inwards, by which the food is thrust between the teeth in manducation.

Motions of the Lower Jaw.

THE motions of the Lower Jaw are as follow:

Elevation, Depression, Protrusion, Retraction, and a lateral grinding or rotatory motion.*

* The motions of the Upper Jaw are so confined, that some men have denied it to have any; it nevertheless rises a little when the Lower Jaw is depressed, but it is principally by the depression of the latter that the mouth is opened. The muscle at the back of the neck, and that part of the Digastric muscle nearest the Mastoid process, produce a slight elevation of the upper jaw, which moves with the whole head, to the bones of which it is firmly united. The connection of the upper jaw with the bones of the head, renders it less moveable in man than in the greater number of animals, in which, freed from the enormous weight of the head, it stretches out in front of that cavity over the lower jaw.

As we follow downwards the scale of animal existence, the motions of the upper jaw are seen to increase the further we descend from the human species. It is equal to that of the lower jaw in reptiles, and in several fishes; hence the enormous dimensions of the mouth of the Crocodile and Shark; hence the circumstance of serpents frequently swallowing prey of a bulk greater than their own, which would cause suffocation but for the power they possess of suspending respiration for a long time, and of waiting patiently till the gastric juice dissolves the food as it is swallowed.

The muscles raising the Lower Jaw are	The Temporalis. The Masseter. The Pterygoideusint.

In the act of mastication, the upper jaw may be considered an anvil, on which the lower jaw strikes as a moveable hammer; and the motions of the under jaw, the pressure it exerts, and it's efforts, would soon have disturbed the connexion of the different bones of which the face is formed, if this unsteady edifice, merely formed of bones in juxta position, or united by sutures, was not supported, and did not transmit to the skull the double effort which presses upon it from below upwards, and pushes it out laterally. Six vertical columns, the ascending apotheses of the Superior Maxillary bones, the orbitar processes of the Malar bones, and the vertical processes of the palate bones, support and transmit the effort which takes place in the first direction, while the zygomatic processes forcibly press the bones of the face against each other, and powerfully resist separation outwardly and laterally.

The lower jaw falls by its own weight when its elevators are relaxed, the external pterygoid muscle, and those attached to the os hyoides, complete this motion, the centre of which is not the articulation of the jaw to the temporal bones, but corresponds to a line that should cross the coronoid processes a little above the angles of the jaw. It is round this axis, that in falling the lower jaw performs a motion of rotation, by which its condyles are turned forwards, while its angles are carried backwards.

In children, the coronoid processes standing off at a smaller distance from the body of the bone, of which

they have nearly the same direction, the centre of motion is always in the glenoid cavities, which the condyles never quit, however much the jaw may be depressed. By this arrangement nature has guarded against dislocation, which would have been frequent at an early period of life from crying, during which the jaw is depressed beyond measure; or when not knowing the just proportion between the capacity of the mouth and the size of the bodies they would put into it, children endeavour to introduce those which it cannot receive. The lower jaw forms a double bended lever of the third kind, in which the power, represented by the temporal, masseter, and internal pterygoid muscles, lies between the fulcrum and resistance, at a smaller or greater distance from the chin.

In carnivorous animals, the levator muscles of the lower jaw, especially the temporals and masseter, are prodigiously large and powerful. In them the coronoid processes, to which the temporal muscles are attached, are very prominent, and the condyles are received into a deep cavity; whilst in herbivorous animals, on the contrary, they are less strong and bulky; and the pterygoid muscles, by whose action the lateral or grinding motion is performed, are strong and more marked. The glenoid cavities are also in them, wide but shallow, so that they allow the condyles to move freely on their surface.

The comparative power of the levator and abductor muscles of the lower jaw, may be easily appreciated by viewing the Temporal and Zygomatic fossæ. Their depth is always in an inverse ratio, and proportioned in the bulk of the muscles which they contain. In carnivorous animals the Zygomatic arch to which the mas-

Those depressing it	Are the muscles placed between the lower jaw and os hyoides, that bone being made a fixed point, by means of muscles inserted into it.*
Those protruding it	The external Pterygoid. The outer part of the Masseter. And, in some degree, the anterior fibres of the Temporal.
Those drawing it back are	The posterior fibres of the Temporal. The inner fibres of the Masseter. And, slightly, the Internal Pterygoid.

The rotatory motions are performed by the Pterygoidei.

The Temporal muscle arises from the Temporal Fossa of the Frontal, Parietal, and Temporal bones, likewise from the tendinous aponeurosis covering them. Its fibres pass down-

seter is attached, is depressed, and seems to have yielded to the efforts of the muscle. In the point of view we have just taken, man holds a middle station between carnivorous animals and those which feed on vegetable substances; nothing, however, determines his nature better than the composition of his dental arches.—Richerand's Physiology, p. 92.

* The Lower Jaw requires muscles of great power to grind the food, and consequently it is furnished with the Temporal, Masseter, and Pterygoid muscles, but it is depressed in a great measure by its own weight.

wards in a radiated manner, and are inserted into the Coronoid Process of the Lower Jaw, which they firmly embrace.

The Masseter arises from the Superior Maxillary bone, where it joins the Os Malæ, and from the whole length of the under and inner edge of the Zygoma. The outer part of the muscle slants backwards, and the inner part forwards. It proceeds downwards, covering the Coronoid Process, and is inserted into the angle of the Lower Jaw and the space between it and the Coronoid Process.

The Internal Pterygoid muscle arises from the Pterygoid fossa of the Sphenoid and Palate bone, and passing downwards and outwards, is inserted into the inner side of the angle of the Lower Jaw.

The External Pterygoid muscle arises from the outer part of the Pterygoid process of the Sphenoid bone and Tuberous Process of the Superior Maxillary bone, and passing backwards and outwards, is inserted into a pit anterior to the cervix of the Lower Jaw.

The Digastric muscle arises from the groove at the root of the Mastoid Process of the Temporal bone, and passes downwards and forwards, forming a strong tendon, which runs

through the Stylo Hyoideus, and is then fixed by a tendon to the Os Hyoides; it afterwards passes upwards and forwards, and is inserted into a rough sinuosity at the under part of the Symphysis of the Lower Jaw.

The Mylo Hyoideus arises broad from the inside of the Lower Jaw, between the last Dens Molaris and the middle of the chin from the linea Mylo Hyoidea, and running down behind the Digastricus, is inserted into the lower edge of the body of the Os hyoides.

For a description of the other muscles placed between the Lower Jaw and Os Hyoides, see Fyfe's Compendium of Anatomy, p. 164, vol. 1.

LIGAMENTS.

Ligaments are strong, white, flexible substances, connecting bones to each other.

Every moveable joint has a Capsular Ligament, which assists in the secretion of synovia, and prevents other parts near it from being pinched in the joint.*

* The Lower Jaw can only be dislocated forward, and either one or both of its condyles may become displaced in this direction.

Every dislocation, except that forward, is rendered impossible by the formation of the parts. The Lower Jaw cannot be dislocated forwards, unless the mouth, just before the occurrence of the accident, be very much open. Whenever the chin is considerably depressed, the condyles slide from behind forward, under the transverse root of the zygomatic processes. The cartaliginous cap which covers the condyles, and follows them in all their motions, still affords them an articular cavity; but the depression of the bone continuing, the ligaments give way, the condyles glide before the eminentiæ articulares, and slip under the zygomatic arches. Hence a dislocation mostly happens when the patient is laughing, gaping, &c. Whenever the jaw has been once dislocated, the same causes more easily reproduce

Other Ligaments join bones together, and preserve them in their proper situation.

the occurrence. There are persons who can scarcely ever laugh heartily without their jaws being luxated.

Dislocations of the Lower Jaw may be attended with a great deal of pain; which Boyer imputes to the pressure produced by the condyles on the deep-seated temporal nerves, and those going to the Masseters, which nerves pass before the roots of the zygomatic process. The mouth is wide open and cannot be shut. It is more open in recent dislocations than in those which have continued some time. An empty space is felt behind the ear, in the natural situation of the condyles. The Coronoid process forms under the cheek bone a prominence, which may be felt through the cheek, or from within the mouth. The cheeks and temples are flattened by the lengthening of the Temporal, Masseter, and Buccinator muscles. The Saliva flows in large quantities from the mouth, the secretion of which fluid is greatly increased by the irritation of the accident. The arch formed by the teeth of the Lower Jaw is situated more forward than that formed by the teeth of the Upper Jaw. During the first five days after the accident, the patient can neither speak nor swallow. When one condyle only is dislocated, the mouth is distorted and turned towards the opposite side, while the fellow teeth of the Jaws do not correspond. However, Mr. Hey asserts, that frequently the position of the chin is not perceptibly altered. The mouth cannot be shut; but it is not so widely open as in complete luxation. Dislocations of the Lower Jaw may be reduced

The Ligaments of the Lower Jaw are three; the Capsular Ligament, the Lateral Ligament, and the Suspensory Ligament of the Stylo Glossus.

The Capsular Ligament on each side arises from the whole margin of the articular cavity of the Temporal bone, and is inserted first into the edge of the interarticular cartilage, and afterwards round the cervix of the lower jaw.

The Lateral Ligament arises from the margin of the articular cavity of the Temporal bone, and is inserted into the inner surface of the angle of the Lower Jaw, near it's

in the following manner: The Surgeon is first to wrap some linen round his thumbs, to prevent their being hurt by the patient's teeth, and then introduce them into the mouth as far back as possible along the Molar teeth. At the same time he is to place his fingers under the chin and base of the jaw, and while he depresses the Molares with his thumbs, he raises the chin with his fingers, by which means the condyles become disengaged from their situation under the Zygomas; at which instant the Muscles draw those parts so rapidly back into the articular cavities again, that the Surgeon's thumbs might sometimes be hurt, did he not immediately move them outward between the cheek and jaw.—Cooper's Surgical Dictionary.

posterior foramen; assisting to keep the jaw in situ, and to prevent the inferior Maxillary vessels from being injured by the action of the Pterygoid muscle.

The Suspensory Ligament of the Stylo Glossus is attached by one end to the Styloid process of the Temporal bone, and by a Ligament running from that process to the Os Hyoides, and by the other end to the angle of the Lower Jaw, serving to support the Stylo Glossus, and gives origin to a part of it.

INTERARTICULAR CARTILAGES,

Are insensible substances, placed between certain joints to break the force of collision, and prevent the jarring pain that would ensue from bones triturating one against the other.

An interarticular cartilage is situated between the condyles of the lower Jaw and articular cavities of the Temporal bones. Their interposition prevents the pain and head ache that would ensue from these bones rubbing against each other when triturating the food.

SYNOVIA,

Is a thin mucilaginous liquor resembling the glair of an egg, and is secreted from small glands situated within most joints.

These Organs are small masses of fat, covered by a continuation of the inner layer of the capsular ligament, projecting in such a manner as to be gently pressed by the motions of the joint; and in proportion to this motion, the fluid is discharged in greater or less quantity.

This fluid serves for the lubrication of the joint.

SALIVARY GLANDS.

The Salivary Glands consist of three large ones on each side of the face, viz. the Parotid, the Submaxillary, and the Sublingual; besides many small glands named from the parts to which they belong.

They are of a yellowish colour, and irregular on their surface, being of the conglomerate kind.

The Parotid. which is the largest, occupies the whole space between the ear, Mastoid and Styloid processes, and the angle of the Lower Jaw, extending superiorly to the Zygoma, and anteriorly to the Masseter, part of which it covers. It's under end lies contiguous to the Submaxillary gland; numerous branches arise from it, which joining together form the Stenonian duct passing from the upper and fore part of the gland.

The Stenonian Duct traverses the Massater about it's middle height, where the muscle is tendinous, in consequence of which it is free from compression, and descends a little to

perforate the Buccinator and membrane of the mouth, by an orifice without any papilla, opposite to the second and third Dens Molaris of the Upper Jaw.

The Submaxillary Gland is smaller and rounder than the Parotid, and is situated on the inside of the angle of the Lower Jaw, between it and the tendons of the Digastricus, and directly under the Platisma Myoides.

From the upper and fore part of this gland a duct arises, called by some authors the Warthonian duct, much thinner in it's coats than the former duct, but longer. It passes forwards between the Mylo Hyoideus and Genio Glossus, along the under and inner edges of the Sublingual gland to the side of the Frænum linguæ, and terminates behind the Dentes Incisores by a small orifice in form of a papilla.

The Sublingual Gland is smaller, longer, and softer than the Submaxillary, and is flat and of an oval form. It is situated under the anterior lateral portion of the tongue, above the duct of the Inferior Maxillary Gland, near the Lower Jaw, between the Mylo Hyoideus and Genio Hyo Glossus, the former of which sustains it.

It opens by several orifices, arranged in a line near the gums, a little to the outside of the frænum. In many quadrupeds, there is a distinct duct belonging to this gland, like that of the Submaxillary.*

* The mechanical trituration is not the only change that the food undergoes in the mouth. Subjected to the action of the organs of mastication, which overcome the force of cohesion of it's molecules, it is at the same period embued with saliva. This fluid, secreted by the glands placed in the vicinity of the mouth, is poured in considerable quantity into that cavity during mastication.

The Saliva is a transparent and viscous fluid, formed of about four parts of water and one of albumen, in which are dissolved phosphate of soda, of lime, and of ammonia, as well as a small quantity of muriate of soda. Like all other albuminous fluids, it froths when agitated, by absorbing oxygen, for which it appears to have a strong affinity. It's affinity for oxygen is such, that we may oxydise gold and silver by triturating in saliva thin leaves of these metals, which are of such difficult oxydisement. The irritation occasioned by the presence or desire of food, and by mastication, excites the salivary glands, they swell and become so many centres of fluxion, towards which the humours flow abundantly. Borden first called the attention of physiologists to the great number of nerves and vessels received by the Parotid, Maxillary, and Sublingual glands, from the Carotid, Maxillary, and Linguil arteries; and from the portio dura of the seventh pair of nerves; and

The use of these glands is to secrete the Saliva.

from the lingual branch of the fifth pair, which penetrate their substance, or pass over a portion of their surface. This great number of vessels and nerves is proportioned to the quantity of saliva secreted, and this is estimated at about six ounces during the average time of a meal. It flows in greater quantity when the food is acrid and stimulating; it mixes with the mucus copiously secreted from the glands, and with the serous fluid exhaled by the exhalent arteries of the mouth. The saliva moistens, imbues, and dissolves the ball formed by the aliment, brings together it's divided molecules, and produces on them the first change. There can be no doubt, that the saliva, mixing with the food by the motion of the jaws, absorbs oxygen, and unites to the alimentary substances a quantity of that gas fit to bring about the changes they are ultimately destined to undergo.

The Muscular parietes of the mouth are, during mastication, in perpetual action. The tongue presses on the food in every direction, and brings it under the teeth; the muscles of the cheek, especially the buccinator, against which the food is pressed, force it back again under the teeth, that it may be duly triturated. When the food has been sufficiently divided, and imbued with saliva, the tip of the tongue is carried to every part of the mouth, and the food is collected on it's upper surface. The food having been thus completely gathered together, the tongue presses it against the roof of the mouth, and turning it upwards at the same time that it's base is depressed, there is offered to the

food an inclined plane, over which the tongue presses it from before backwards to make it clear the isthmus of the fauces, and to thrust it into the œsophagus. In this course of the food along the pharynx, and into the œsophagus, consists deglutition; a function assisted by the co-operation of several organs whose mechanism is rather complicated.—Richerand's Physiology, p. 96.

ANGIOLOGY,

OR THE

DOCTRINE OF BLOOD-VESSELS.

The blood-vessels are divided into arteries and veins.

The Arteries.

The arteries are elastic canals, conveying blood from the Heart to the different parts of the body, and are distinguished from veins by their pulsations.

Properly speaking, there are but two large arteries in the body, viz. the Aorta,* and the

* The Aorta arises from the posterior and right side of the left Ventricle of the heart, corresponding to the fourth dorsal Vertebra; it proceeds upwards, inclining to the right side, behind the middle bone of the Sternum, forming the Sinus Aorta; coming even with the second dorsal Vertebra, it makes a turn, passing obliquely from before backwards, and from right to left behind the first bone of the Sternum, there forming it's arch. It gets in contact with the third dorsal Vertebra, and then descends on the left side of all the dorsal Vertebra, in the posterior and left side of the posterior

Pulmonary Artery;* the Aorta, for conveying blood from the heart to the different parts of the body for its nourishment, &c.; and the Pulmonary Artery, for conveying the Chyle from the Heart to the Lungs for the purpose of vivification.

Arteries are distinguished from veins by the whiteness of their colour, and by the thickness of their coats.

The use of the arteries is to assist in conveying the blood from the Heart to the different parts of the Body for it's nutrition, to assist in converting the Chyle into blood, to nourish the body, promote it's growth, to form the different secretions, and to renovate parts destroyed by accident or disease.

The arteries passing to the Teeth are ramifi-

Mediastanum, through the Foramen Posticum Diaphragmatis, there becoming Abdomidal Aorta.

* The Pulmonary artery arises from the posterior and left side of the right Ventricle of the Heart, and ascends up behind the Sternum within the Pericardium, inclining a little to the left side. Having got corresponding to the concave side of the Arch of the Aorta, it divides into right and left branches, which proceed to the Lungs, conveying the impure blood into them for the purpose of undergoing a change subservient to the principles of life.

cations from the Internal Maxillary branch of the External Carotid.

The Internal Maxillery artery, with the superficial Temporal is the ultimate division of the External Carotid. The division takes place corresponding to the cervix of the Lower Jaw.

The External Carotid arises from the bifurcation of the Common Carotid, and proceeds upwards beneath the Stylo Hyoideus, the posterior belly of the Digastricus, behind the angle and ascending ramus of the Lower Jaw. It is bounded anteriorly by the ascending ramus and Masseter Muscle; and posteriorly by the Mastoid Process and anterior Margin of the insertion of the Sterno Cleido Mastoideus. It lies deeply embedded in the Parotid Gland, and passes up 'till it gets corresponding to the cervix of the Lower Jaw, where it divides into the Superficial, Temporal, and Internal Maxillary arteries. It's branches, or rami, are three externally, the Thyroideus Superior, the Lingualis, and the Maxillaris Externus; one internally, the Pharyngeus Ascendens Halleri: two posteriorly, the Occipitalis and Posterior Auris, and the two ultimate divisions of the artery, the Temporalis Superficialis and Maxillaris Internus.

The External Maxillary Branch proceeds

upwards behind the posterior belly of the Digastricus and Stylo Hyoideus, and pervading the substance of the Submaxillary Gland, passes over the base of the Lower Jaw, corresponding to the anterior margin of the Masseter Muscle, and going tortuously up by the side of the angle of the mouth, passes between the insertion of the Zygomaticus Major and Minor, by the side of the nose to the inner canthus of the eye, where it inosculates with the Opthalmic Artery, forming a communication between the External and Internal Carotids.

It gives off various branches; the principal connected with the mouth are the Coronary ones, which form a circle round the lips, lying just under the membrane of the mouth.

The Internal Maxillary Branch

Turns round the posterior part of the cervix of the Lower Jaw; passing, first, between the Pterygoideus Externus and cervix of the bone, then between the Pterygoideus Externus and Internus, and, running towards the orbit, gets corresponding to the Spheno Maxillary fissure, where it divides into numerous branches. These are as follow: Menin-

geus Medius, Meningeus Parvus, Maxillarus Inferior, Pharyngeus descendens, Temporalis profundissimus, Lacrymalis, and infra orbitalis.

The Maxillaris Inferior, or Inferior Maxillary Artery, is the first branch connected with the Teeth. It passes downward between the two Pterygoidei, then through the Canalis Mentalis, being protected at its entrance by the Ligamentum Laterale. As it is passing through the Canal, it gives dental branches upwards to the Teeth. The remainder of the artery makes its exit through the Anterior Mental Foramen, and inosculates with branches of the Facial artery.

The next branch that we must consider is the Pterygo Palatine. It passes through the Canalis Pterygo Palatinus, and proceeding along the inner side of the Alveoli, after sending branches to the Teeth, passes to the Foramen Palatinum Anticum, inosculating with the Spheno Palatine branch.

The Spheno Palatine branch, like the nerve, passes horizontally inwards through the Foramen Spheno Palatinum, runs along the Septum to the floor of the nose, and passing to the Foramen Palatinum Anticum, inosculates with the Pterygo Palatine. From

this inosculation, small branches pass through the substance of the bone, and proceed to the Incisor Teeth.

The Alveolar branch runs round the tuberous process of the Os Maxillare Superius, and supplies the soft parts at the back of the Upper Jaw, and outside of the Alveolar process, sending small branches inwards to the Molar teeth.

The Infra Orbitar branch passes through the Infra Orbitar canal, and sends down small branches to the Canine Tooth and the Bicuspides.

From this description, it will be perceived, that the incisor teeth receive their vessels from the Spheno and Pterygo Palatine branches; that the Canine and small Molar teeth receive theirs from the Infra Orbitar branch; and that the large Molar teeth are supplied by branches sent from the Alveolar and Pterygo Palatine.

Veins.

Veins are tubes returning the blood from the different parts of the body to the Heart.

Veins differ from arteries, having no pulsa-

tion, and being furnished with valves. The Colour of veins is blueish, and, when full of blood, appear of a purple tinge.

Veins are capable of suffering greater distension than arteries, and their anastamosing branches are greater and more frequent. The use of the valves is to prevent regurgitation.

The Veins convey the blood from the extremities of the Arteries, with the Chyle and Lymph from the Absorbents, to the Heart. They in general accompany the Arteries.

Those conveying blood from the face and tec[illegible] terminate in the Jugulars, which empty themselves into the Subclavian Veins.

The Subclavian Veins pass anteriorly to the Scalenus Anticus, over the first rib behind the first bone of the Sternum, and corresponding to the cartilage of the first right rib, join each other, and terminate in the Vena Cava Superior; which proceeds downwards, perforates the Pericardium, having passed on the right side of the Ascending Aorta, and terminates in the right Auricle of the Heart.

THE ABSORBENTS.

The absorbents are small delicate pellucid tubes, which are supposed to exist in all parts of the system, although they have not been discovered in the cavity of the Cranium and Spine. They carry a transparent fluid or lymph, and with the Lacteals of the intestines form what is called the absorbent system.

They take up substances from the surface of the body, or from cavities, and convey them into the blood, commencing by numberless open mouths not visible to the naked eye. They arise from the external surface of the body, from the Cellular substance, from the surface of the large cavities, and from the internal coats of the Intestines.

In some parts of the body they run in two sets, a superficial and a deep seated; this latter accompanying the large Arteries. Very minute injections have proved them to be furnished with blood-vessels, and this appears evident from their being susceptible of in-

flammation; the pain which attends it, indicates the presence of nerves.

The coats of the Absorbents are very thin and transparent, and from this their number has not been enumerated. The Absorbents are best shewn when distended with mercury and their coats are strong enough to support a considerable column of it.

Throughout their whole extent they are intercepted by Valves, which are placed in pairs; and in their termination, whether in the Thoracic duct, or in red veins, there is always one, commonly two Valves, to prevent the contents of the ducts or of the veins passing into them.

The Absorbents have glands belonging to them, through which they pass; these are generally situated in the cellular substance, under the skin, and about the great blood-vessels.

The Absorbents of the intestines are termed Lacteals; they convey the Chyle from them to the Thoracic duct, and when distended with the white milky fluid, have a knotty appearance. They arise from the internal coat of the small intestines, perforate the other coats, and pass between the lamina

of the Mesentery, and through glands, which they partly form, unite with the Lymphatics from the inferior extremities, and from other parts, and form the Thoracic duct.*

* It will be necessary to explain something relating to the food in its passage through the alimentary canal, and the manner in which the Chyle is converted into blood.

The food is received into the Mouth, masticated between the Teeth, imbued with salavi, and forced through the Constrictors of the Pharynx down the Œsophagus into the Stomach. It is there mixed with the gastric juice, which is secreted from the inner surface of the Stomach; and this is found to be the immediate agent for effecting the change that the food there undergoes. A knowledge of no part of Physiology is more uséful than of the digestive organs; and in every disease, sore or ulcer, their healthy state must be particularly attended to.

The peculiar properties of Gastric juice render it one of the most wonderful productions of the animal body; it is not a simple diluent, but a solvent, and has the power of breaking down the food, and converting it into a soft homogenous paste known by the name of chyme. So powerful is it's faculty of solution, that the hard bones which dogs devour cannot resist its action. It not only unites with and dissolves the food, but changes it's nature and composition. It is found to be of an antiseptic property, and corrects putrescency instead of inducing it. After the food has been properly acted on by the Gastric juice, it passes through a muscular

The Thoracic duct crosses over the left side of the Spine, behind the Œsophagus, and

contraction of the stomach, called the Pylorus, into the Duodenum.

After the food has entered the Duodenum, it undergoes other changes equally as essential as those already produced on it in the Stomach; it mixes with the bile brought by the ducts from the liver, and with the pancreatic fluid from the Pancreas; and having remained some time exposed to the actions of these fluids, it is separated into two parts, an excrementitious, and a nutritious.—For the difference between the duodenum and the other intestines, and the nature of bile, &c. see Richerand's Physiology, p. 119.

After the food has remained a certain time within the duodenum, and this separation has taken place, it proceeds along the other small intestines, viz. the jejunum and ileum, and its progress is retarded by their numerous convolutions and by the circular folds of their inner membrane, called by anatomists valvulæ conniventes; both these decrease in number towards the termination of the Ileum. By means of the peristaltic contractions of the intestines, the nutritious part of the food is said to be pressed out; and this is taken up by means of the inhalent mouths of the lacteals. The alimentary mass parts gradually with it's nutritive particles, and passes from the small into the large intestines, viz. into the cœcum, colon, and rectum. It's motion is now more accelerated, and nearly all its chyle is absorbed; but the little remaining is taken up by absorbents which still exist. In the large intestines, the alimentary sub-

beginning of the Aorta descendens, emerges from the Thorax, and passes up between the

stance becomes fœcal, and is forced into the rectum, from whence it is expelled by an action which it's presence excites.

The nutritious part of the food taken up by the lacteals is conveyed by different branches into the Thoracic duct, and from thence into the left subclavian vein, where it mixes with the blood brought back from the upper extremities. The Subclavian veins terminate in the Vena Cava, and the Vena Cava in the right Auricle of the heart. The reason for the chyle entering the blood in the subclavian vein is explained as follows, in Paley's Theology: "The chyle enters the blood in an "odd place, but perhaps the most commodious place "possible, viz. at a large vein in the neck, so situated "with respect to the circulation, as speedily to bring "the mixture to the heart. And this seems to be of "great moment; for had the chyle entered the blood at "an artery, or at a distant vein, the fluid, composed of "the old and new materials, must have performed a "considerable part of the circulation before it received "that churning in the lungs which is probably necessa-"ry for the intimate and perfect union of the old blood "with the recent chyle."

It is now necessary that this new venous blood, which is of a dark colour, should undergo changes indispensable to life. The right auricle contracting, the blood is propelled into the right ventricle, and from the ventricle it is further forced through the pulmonary artery into the lungs. While circulating through them,

Internal Jugular Vein and Longus Colli as high as the fifth or sixth Vertebra of the neck, then makes a turn downwards terminating in the left Subclavian vein, at the angle formed between it and the left internal Jugular.

The use of the Absorbents is to take up substances which are applied to their mouths, and thus the vapour of circumscribed cavities, and of the cells of the cellular membrane, are removed by the lymphatics of those parts; and mercury and other substances are taken

it is exposed in the air cells to the atmospheric air taken in during respiration; a change takes place, the blood becomes of a florid red colour, subservient to the principles of life, and is returned by the Pulmonary veins into the left auricle of the heart, and passing from thence into the left ventricle, which contracting, propels it by means of the Aorta to all parts of the body.

Different opinions are entertained of the change which the blood undergoes in the lungs. Some physiologists imagine that it receives oxygen from the air; whilst others state it gives off it's superabundant carbon, and that the air is expired as carbonic acid gas.

It is here sufficient to state, that the change is necessary to life, and that the blood sent to the lungs is of a dark colour, while that which returns from them is of a florid red, subservient to the functions of the animal œconomy.

into the system, when rubbed on the skin. By the same rules, any piece of fractured bone protruding is blunted and absorbed by the action of these vessels, and thus, after the extraction of a tooth, the edge of the socket is absorbed, and the gum heals over it.

The principle by which this absorption takes place, is a power inherent in the mouths of the absorbent vessels, a vis incita, dependant on the high degree of irritability of their internal membrane, by which the vessels contract and propel the fluid forwards. Hence the use of this function appears to be of the utmost importance, viz. to supply the blood with Chyle; to remove the superfluous vapour of circumscribed cavities, otherwise dropsies, as hydrocephalus, hydrothorax, hydrocardia, ascites, hydrocele, &c. would be constantly taking place; to remove the hard and soft parts of the body; and to convey into the system medicines which are applied to the external surface of the skin.

NEUROLOGY,

OR THE

DOCTRINE OF THE NERVES.

Nerves are white cords, supposed to be continued from the brain and spinal marrow.

They are composed of minute fibrillæ, which, although they evade the naked eye, can be with facility seen by the assistance of the microscope. Nerves are supplied with minute arteries from the neighbouring blood-vessels. In some parts of the body they unite together and form a plexus; in others, uniting they form a trunk; and in some places a knot which is called a ganglion.

The nerves constitute the immediate organs of sensation, and convey impressions made on them to the mind; but the manner in which these impressions are produced, and the means by which the will is conveyed from the brain to the different muscles, remains still in obscurity.

It is supposed that sensation is conveyed to the brain by means of a vibration communicated to the nerves, or by a nervous fluid contained in them; and some imagine, that it is by an Electric matter common to them and many other substances.

Nerves of the Teeth.

The teeth receive their Nerves from the Superior and Inferior Maxillary branches of the Par Trigeminum, or fifth pair of nerves.

The Par Trigeminum arises from the junction of the Crura Cerebri* and Pons Varolii. It passes downwards and outwards, perforating the Dura Mater, and sinking close by the outside of the Cavernous Sinus, corresponding to the extremity of the petrous portion of the Temporal bone, forms the Ganglion Glasserii. From this ganglion, which is of a semilunar form, three principal branches are given off, viz. the Opthalmic, the Superior Maxillary, and the Inferior Maxillary.

* For a description of the brain, see Fyfe's Compendium of Anatomy, vol. 2. page 28.

We shall proceed to describe the Maxillary Nerves.

The Superior Maxillary Nerve arises from the Ganglion Glasserii; and making it's exit through the foramen rotundum of the Sphenoid bone, forms the Ganglion Micheli, corresponding to the tuberous process of the Os Maxillare Superious.

It's branches are, the Pterygo Palatine, the Spheno Palatine, the Viduan, and the Infra Orbitar.

The Pterygo Palatine descends through the canal leading to the Foramen Palatinum Posticum, and running near the Alveoli with considerable blood-vessels, sends branches to the Velum Palati and palate plate of the Superior Maxillary bone.

It sends some filaments, which pass round the Upper Jaw and vanish in the cheek.

Others, which run round the back part of the bone and supply it's substance, the large Molar teeth, and the membrane lining the Antrum Highmorianum.

The Spheno Palatine nerve, after sending a branch to join the great Sympathetic in the Canalis Caroticus, and another which enters the Foramen Innominatum to join the Portio

Dura of the seventh pair of nerves, proceeds horizontally inwards through the Foramen Spheno Palatinum to the side of the nose, and goes along the Septum contiguously to the floor, and through the Foramen Palitinum Anticum to the roof of the mouth, where it inosculates with the Pterygo Palatine nerve. Small filaments are sent fowards through the substance of the bone to the Anterior Incisor teeth.

The Viduan branch is given off from the Spheno Palatine, and divides into two filaments; one which goes to join the great Sympathetic in the Canalis Caroticus, and the other enters the Foramen Innominatum to join the Portio Dura of the seventh pair of nerves.*

* The portio dura passes through the largest foraminula of the fossula parva, at the bottom of the meatus auditorius externus, and proceeds through the petrous portion of the temporal bone, behind the cavitas tympani, and emerges from the foramen Stylo Mastoidem, being bounded anteriorly by the ascending ramus of the lower jaw and posterior margin of the Masseter muscle, and posteriorly by the Mastoid process and anterior margin of the insertion of the Sterno Cleido Mastoideus, lying deeply embedded in the Parotid Gland. It emerges from it's anterior margin, and divides into

The Infra Orbitar Nerve appears to be a continuation of the trunk from the Ganglion Micheli. It passes through the Foramen Lacerum into the orbit, enters the Canalis Infra Orbitalis, and passing through it, emerges at the Foramen Infra Orbitale,* between the Le-

numerous filaments on the face, forming a rete nervosum, which has received the name of the pes Anserinus. Branches of the pes anserinus communicate with the Infra Orbitar nerve, and with the Inferior Maxillary nerve, after having made it's exit from the mental foramen. In its passage through the foramen Auditivum internum, the portio dura receives a filament from the Viduan twig; and as it proceeds through the Aquaductus Fallopii, it gives off a reflected filament named Chorda Tympani, which passes between the manubrium mallei and the processus longus incudis, and emerges at the fissura Glasserii, communicating with the gustatory twig of the inferior maxillary branch posteriorly to the Pterygoideus externus. It is by means of this communication that pain is often felt in the ear when a tooth in the lower jaw is suffering from the nerve being exposed.

* It is this branch of the fifth pair of nerves that is most frequently affected with tic doloureux; and the seat of the disease is in general corresponding to the infra Orbitar twig.

Although many authors have considered this painful and distressing disease, it is much to be lamented, that a treatment without the employment of the scalpel has not yet been successfully adopted, as it throws into the

vator Labii Superioris and Levator Anguli Oris, its filaments communicating with a

most excruciating torture those unhappy patients whose lot it is to be afflicted by it. The most frequent part affected is corresponding to the termination of the Infra Orbitar nerves; although it is sometimes felt in the forehead, inner canthus of the eye, and globe of the eye itself. An attack first commences with slight and almost imperceptible pain, but with sensations well known to the patient as prior to the torture he is about to endure. It becomes more and more acute and painful, and shoots in the most excruciating manner across the ramifications of the affected nerve. The pain is happily not of long duration, it in general never continues half a minute, and never exceeds one minute. It returns at intervals, but there is no determinate period as to the length of the intervals.

When the pain is exceedingly violent, the parts are often convulsed, and the patient's countenance is often thrown into various contortions; the violence, however, of the pain sometimes varies, at times being attended with the most insupportable anguish, and at others being more bearable.

Authors tell us, that the lower jaw in general remains immoveable during the attack; that the patient seems to dread the slightest motion of the body; but that his forced attitude, and his almost extatic state, express the violence of his sufferings.

One or more instances are on record of this disease terminating fatally; and some authors assert, that it is frequently followed by other serious evils, whilst other

branch of the Pes Anserinus. While in the Infra Orbitar Canal, small branches are sent

maintain that it is only injurious to the constitution during the paroxysms.

The period of life when this malady makes it's appearance is between the fortieth and fiftieth year, although cases are detailed in the Mem. de la Soc. de Paris of it occurring much earlier. It would, however, seem, that when the functions begin to be impaired, and the frame to show marks of approaching decay, that the disease is produced; but most probably it is caused by some constitutional irritation. Exposure to damp, stormy, tempestuous weather, is said to bring on an attack; also external injuries, and depressing passions of the mind. When the disease is once established in the system, the slightest causes will sometimes bring on a paroxysm; such as a touch with a handkerchief, or the muscular motions of the face in eating, drinking, or speaking. The process of shaving is much dreaded by the sufferers, as well as blowing the nose.

Diagnosis.—It has been said by authors, that tic douloureux is caused by carious teeth which exist in the mouth; but their extraction has been resorted to without any success. The disease called tooth-ache is caused by the nerve of a tooth being exposed by decay, but the pain differs in the two very materially. The teeth in general begin to decay early in life; by the time a person has arrived at his fiftieth year, it often happens that most of them have been extracted; and this is the period when tic douloureux appears.

In tic douloureux, the pain is superficial, the pa-

down through the substance of the bone, which supply the Canine and small Molar teeth.

roxysms are short, they cannot be relieved, and dart in a lancinating manner in several directions. In odontalgia, or tooth-ache, the pain is lasting and deep-seated, but can sometimes be alleviated by hot stimulating applications: besides this, a patient is always aware of a bad tooth existing in his mouth; for as soon as the nerve begins to be exposed, pain is felt when any hot or cold liquids are applied to it, and when peculiar substances enter the cavity of the decay. The pain in tooth-ache will subside and return again, but it's return differs very materially from that of tic douloureux; it is not brought on by moving the muscles of the face, or by touching it with different substances. When the internal part of a tooth inflames, the parts around sympathize to a very great extent, and the integuments covering the Jaw bones inflame, and produce symptoms similar to those of hemicrania, the whole side of the face being affected corresponding to the decayed tooth. Considerable pain is sometimes felt along the branches of the pes anserinus, and in the internal ear; the latter pain being caused by the connection between the gustatory twig of the inferior maxillary branch, and the reflected filament of the Viduan twig emerging from the fissure Glasserii, after having passed through the internal ear. The pain, however, is always more mitigated, and lasts longer than that of tic doloreux. From rheumatism, the disease differs, being brought on by slight touches, by the attack being of short duration, and by it's being attended with intolerable pain. It has

From the Ganglion Micheli, small branches are also sent to the Lacrymal Gland and Temporal muscle.

been compared to gout, syphilitic pains, and others; but it is easily distinguished from them.

A disease exists which is called Hemicrania, and is attended with violent pain, and an affection of one side of the face; this will yield to bark, and very often occurs in exposure to cold in very stormy weather.

Treatment.—It is greatly to be lamented, that all medicines which have been tried have failed in curing this disease. Opium, Belladonna, Arsenic, Hemlock, and many others, as well as blisters and all kinds of topical applications have been resorted to, but without success. Electricity has been tried; and although a case is related by Mr. Blunt, in the Medical Journal, of a lady being cured by it, it is generally found as unsuccessful as other applications.

Some years ago, the magnet was said to possess great charms in removing the pain; and in some cases, where it was recent, it is said to have procured ease; but it is now supposed that the mitigation of pain was caused by the patient's imagination being forcibly acted on.

The remedy most successful in the cure of tic douloureux, is making an incision in the affected nerve, cutting off by that means all communication to the sensorium; but the filaments of the nerve of the face are so numerous, and their communications so frequent, that even after the infra orbitar nerve has been divided, the

An alveolar branch turns round the tuberous process of the Os Maxillare Superius, and passes along the outer side of the bone, supplying its back parts and the large Molar teeth.

From this explanation, it will be easy to comprehend the manner in which the teeth of the Upper Jaw are supplied with nerves; the Incisors receive theirs from branches sent forwards from the junction of the Pterygo Palatine and Spheno Palatine at the Foramen Incisivum; the Canine and small Molar teeth receive theirs from branches sent down from the Infra Orbitar Nerves, and the Molares are supplied by the Pterygo Palatine, and Alveolar branches.

The Inferior Maxillary Nerve

Is the largest branch given off from the Ganglion Glasseri. It passes downwards and

pain often returns, and other filaments of nerves are obliged to be cut down on.

Although the operation has been disregarded by some Surgeons, it has been performed with success in this country. The Incision is to be a little more than half an inch below the middle of the under eye-lid, and carried obliquely downwards and outwards.

outwards, through the Foramen Ovale of the Sphenoid bone, then down on the inner side of the ascending ramus between the Pterygoideus Externus and Internus, and passing beween the lateral ligament and the bone proceeds through the Canalis Mentalis.

Its branches are as follow: first a Gustatory branch, which passes between the two Pterygoidei and proceeds to the tongue.

A temporal branch, which goes to the Temporal muscle.

A branch which emerges from the Masseter and passes along the Buccinator.

A small branch given off just as the nerve enters the Foramen Maxillare Posticum, which goes along a sulcus in the bone to the Mylo Hyoideus.

The continuation of the nerve passes through the mental canal, and gives branches upwards to the teeth; it emerges from the Anterior Maxillare Foramen, and communicates with a branch of the Pes Anserinus.

Having explained in nearly as concise a manner as possible, the doctrine of the diffe-

rent parts of anatomy connected with the teeth, we must now proceed to inquire into their nature, growth, &c.

THE TEETH.

The various theories now established relating to these organs have made them well worthy of attention, important, and interesting; like all other parts of the human frame, they clearly point out the diffusive goodness and ineffable wisdom of divine dispensation; and their arrangement and structure are proofs to philosophic minds of the existence of a divine Creator, to whom this whole universe is indebted for its origin.

The hardness of these organs, and their being found in the earth hundred of years after interment, induced the ancients, according to Tertullian, in his Treatise de Resurrectione, to preserve and bury them with their bodies, that they might be rendered entire at the time of the resurrection.

They are so situated, that the superior and inferior rows are capable of being joined though not all at once; that by this means the front and back teeth may be separately put in

action; for when we masticate the food, the molar, or grinding teeth are employed; but the front of the Upper Jaw projecting beyond the lower one, is in a quiet and undisturbed state. In incision, it is the front teeth which are employed; and when we are not engaged in eating, the molar teeth are at rest, and pressure is on the Canine and Incisor teeth.

When we reflect on their alternate employment, and on the beautiful contrivance which presents itself, we cannot but be struck with the exquisite skill with which they are formed: and if we follow down the scale of animal creation, and view the mouths of every genera of quadrupeds, of fishes, and of insects, a succession of most beautiful and interesting designs are open to us, planned according to the exigencies of each creature. Graminivorous quadrupeds have their teeth formed to triturate the food; those of the carnivorous species in a different manner, more pointed, and with long canine teeth, to catch hold and lacerate their prey: omnivorous animals, and every other genera, according to their wants and mode of living; fishes of prey with sharp teeth, and those living by suction with mouths formed in a different manner: birds of prey with sharp,

crooked bills, and those seeking their nourishment in the mud and ground with a different bill, having the gustatory nerves large, and distributed about the tongue very abundantly.

Without the teeth, a due mastication of the food, so indispensably requisite to the preservation of life, cannot go on. And it may be worth our while again to observe a bounty in nature towards the winged tribe; they are not furnished with teeth, but have instead of them a mill, or gizzard, through which the food passes, and in which it is broken down to undergo afterwards the changes necessary for digestion.

The teeth, or dentes, formerly edentes, are destined for the articulation of the voice, for the purposes of mastication, and ornament.

We may now observe, that they consist of two substances, and of them we shall hereafter speak separately. They are in general thirty-two in number, sixteen in each jaw, arranged in a proper manner for breaking down the food.

Hippocrates, in the sixth section of the sixth book of his Epidemics, tells us, that those furnished with a great number of teeth live to a

considerable age; and Bartholine, in his Institutio Anatomica, likewise says, "The fewness of teeth is a sign of penury of nutritive matter, and a weak productive or forming force; it is the cause why the aliments "cannot be sufficiently prepared, by which "means both the first and second concoctions "are vitiated."

Moebius, in his Fundament. Med. Cap. 9. tells us, that God, under the Mosaic dispensation, not only ordered the servants who had their teeth broken or beat out by their masters to be manumitted and set at liberty, but also that the ancients, in the temple of Apollo, suspended a leaden instrument for drawing teeth, intimating that they were never to be extracted but when loose enough to yield to this weight: and Menavius, in Liber 3. Cap. 22. asserts, that the Turks were forbidden to extract a tooth without a license from their Sovereign; some inhabitants of the East Indies, on the contrary, for the sake of additional graces, even now resort to the extraction of their front teeth.

The preservation of the teeth, is certainly a branch of a dentist's profession more beneficial to mankind than is generally imagined;

and as their reproduction is very seldom heard of, it may be gratifying to some to know, that we possess men of science and talent, capable of averting the evil of decays.

I trust I may be allowed to mention the success with which a late eminent practitioner, and a very near relation to me, followed up the preservation of the teeth; and refer my readers, if dentists, to his operations, which may be met with in the mouths of almost every distinguished personage in this country.

The benefit of a reparation of carious teeth, without their total destruction, must every where be acknowledged; and although contrivances are now brought by mechanics to considerable perfection, yet so admirable are all the works of Nature, and so bountiful is her goodness, that gratitude alone, should stimulate us to aim as much as possible at the preservation of all her works.

THE ENAMEL.

No name can perhaps convey to the mind of any one unacquainted with Physiology, a more incorrect idea of this substance than that which is usually given it; inasmuch as it com-

pares one of the most wonderful substances in the animal machine, admirably adapted to the purposes it has to fulfil, to a vitreous or flinty-substance. This enamel is soluble in Muriatic acid; and if to the solution we add oil of Tartar, per deliquiem, there is produced a highly white magistery, in medicinal virtues agreeing with that prepared from a boar's tooth, or the elk's hoof. Such a chemical solution is not to be obtained from flints, or genuine stones. The enamel being perfectly insensible, and incapable of propagating pain to the Sensorium, may be looked upon as quite out of the system; but when we reflect on the manner in which it is formed, and the phenomena which follow, we cannot but see that it is dependant on the vital functions. Instead of owing its origin to some great revolution in nature, or other casualties, it is gradually deposited by the arteries of the Capsule investing the pulp, and is consequently a part of the animal machine, apparently inorganized, but owing its hardness and compact structure to the state of the constitution at the time of teething.

If we give mature deliberation to an appearance of the teeth sometimes put on, called the honeycomb disease, we must inevitably per-

ceive that it is entirely caused by a weakened state of the constitution when young. Here the bony covering is in places exposed, by an insufficient deposition of this enamel at an early period of life. Whenever this disease is found to exist, we may immediately conclude that the process of dentition was not effected without considerable difficulty. About this time, the small arteries of the Capsule investing the secondary teeth, are beginning to deposit their enamel; and if any of the primary ones are protruding, and causing diarrhœa, convulsions, fits, startings at night, and the worst of diseases, the constitution of the child being in a continued state of fever and exhaustion, and the power of life being kept up by the arteries, we must not wonder that any other office is performed imperfectly. This explanation of the disease may be with facility comprehended; but authors have not yet sufficiently elucidated the nature of the defect, to get the fact theoretically established.

The enamel is the hardest substance of the animal body, and forms a very appropriate covering to the parts beneath it: such is its hardness, that by violent attrition or concussion with iron, the dentes molares of large

animals emit quantities of sparks; and the enamel of teeth is often found in church-yards when the bony part has mouldered to dust.

The best method to ascertain its thickness and shape is by the following process: take a tooth and slit it down its middle, make the slit surface even by means of a file, and expose it to the heat of a blow-pipe, wash it with muriatic acid, or scrape it; the enamel will be found retaining its own colour, and the bony part of the tooth will be dark and burnt. We may now very clearly see its extent: it is thickest corresponding to the points and crown of the tooth, and thinnest towards the cervix. It is composed of fibres, so disposed as to form radii round the body of the tooth, nearly perpendicular to its surface. The fibres are straight on the cutting edges and grinding surfaces of their bodies, but curved at the side, with their convex part turned upwards, better enabling them to resist the impression of hard substances placed between them during manducation. The whiteness of the enamel varies with the age and constitution of the patient. In persons subject to dyspeptic complaints the enamel is usually of a very white colour, but that which is most durable is much more trans-

parent and of a deeper tint. In the marmot, beaver, and squirrel, the enamel is of a nut-brown colour on the anterior surface of the Incisor teeth, and the Molar teeth of some cloven-hoofed animals are covered with a black vitreous crust.

It is needless to mention, that the enamel is every where considered as possessing no vascularity; but if the bony part of a tooth has a vital principle in it, depending on circulation, then I must confess that it is curious, that a part possessing life should unite with another not partaking of it, and so long remain without causing any irritation.

By chemical experiments made on the teeth by Mr. Pepys, it was found that one hundred parts of enamel yielded seventy-eight of Phosphate of lime, six of Carbonate of lime, and the parts of composition and loss were sixteen. From this analysis it will be perceived that Phosphate of lime is the principal ingredient in enamel. But authors attribute its hardness to fluat of lime, which is said to exist in it.

Sir Everard Home, in his paper "On the Structure of the Teeth of griminivorous Quadrupeds," tells us, that Mr. Hatchett considers

lime and phosphoric acid to be the essential constituent principles of the parts of the teeth; and adds, that any difference that is to be met with, only seems to be that which would constitute species of the same genus, similar to what is found in the mineral kingdom, under lime-stone, marble, and calcareous spars, these only differing by a small change in the proportions of their constituent principles, and by a different arrangement of their integrant particles. The same author states an instance of a thin crust of polished enamel being found some years ago on the head of a human thigh bone, resembling in appearance that of the teeth; the cartilage covering the head of the bone had been previously removed by disease. This strange appearance could not be accounted for; but the observations which had been made on the enamel, appeared to throw a light on the subject, and some experiments made by Mr. Hatchett on Synovia, proved that a small quantity of phosphate of lime entered its composition.

THE BONY PART OF A TOOTH.

This substance does not partake of the same nature as that we have just considered; and although it's chemical properties are the same as common bone, yet it is differently deposited, and of a firmer consistency, no cancelli appear to exist in it, it has no vascularity, and seemingly no circulation.

Many very eminent Physiologists have doubted whether this bony substance was to be considered as having vascularity, or whether possessing a vitality peculiar to itself, it's principle of life not depending on circulation; on both sides of the question much may be said. The absorption of the roots of the primary teeth, which takes place when the secondary ones begin to enlarge, and the swelling of their roots, similar to a disease called spina ventosa, might induce us to believe that they are furnished with vessels like other bones; but when we examine debilitating diseases, such as Mollities ossium and Rickets, in which the body wastes, and every thing in

the system generally partakes of alteration, we find the teeth remain unchanged. Here the action of the absorbents prevails over that of arteries, the bones yield, and amongst them the Jaw bones become disfigured, but the teeth remain not subject to the absorption which takes place in all other parts of the bone. Another important Phenomenon, clearly proving that the bony part of a tooth is not so subject to irritation as common bone, is, that on exposing it to air it does not exfoliate. These circumstances have induced many Physiologists to conclude, that the teeth possess no vascularity:* but Ruysch, a celebrated Anatomist, tells us, that he had made an injection pass into their hardest part. I have my-

* John Hunter, in his Natural History of the Human Teeth, tells us, "We cannot by injection prove "that the bony part of a tooth is vascular; but from "circumstances it would appear that it is so, for the "fangs of the teeth are liable to swellings of the spina "ventosa kind, like other bones; and they sometimes "anchylose with the socket by bony and flexible conti-"nuity, as all other bones are apt to do. But there "may be a deception here; for the swelling may be an "original formation, and the anchylosis may be from "the pulp that the Tooth is formed upon being united "with the socket. The following considerations

self thrown an injection from the Carotid of an animal into the Periosteum of the teeth, but have not made it go further.

" would seem to shew that the teeth are not vascular ;
" First, I never saw them injected in any preparation ;
" nor could I ever succeed in any attempt to inject
" them, either in young or old subjects, and therefore
" believe that their must have been some fallacy in
" the cases where they have been said to be injected.
" Secondly, we are not able to trace any vessels going
" from the pulp into the substance of the new-formed
" tooth ; and whatever part of a tooth is formed, it is
" always completely formed ; which is not the case with
" other bones. But what is a more convincing proof,
" is reasoning from analogy between them and other
" bones, when the animal has been fed with madder.
" Take a young animal, viz. a pig, and feed it with
" madder for three or four weeks ; then kill the animal,
" and upon examination you will find the following ap-
" pearance : first, if this animal had some part of it's
" Teeth formed before the feeding with madder, those
" parts will be known by their remaining of the natu-
" ral colour ; but such parts of the teeth as were form-
" ed while the animal was taking the madder will be
" found to be of a red colour. This shews that it is
" only those parts that were forming while the animal
" was taking the madder that are dyed ; for what were
" already formed will not be found in the least tinged.
" This is different in all other bones ; for we know,
" that any part of a bone which is already formed, is
" capable of being dyed with madder, though not so

The sensibility of the bony part of the tooth appears great, but whether this pain proceeds

" fast as the part that is forming; therefore, as we " know that all other bones when formed are vascular, " and are thence susceptible of the dye, we may readily " suppose that the teeth are not vascular, because they " are not susceptible of it after being once formed. " But we shall carry this still further: if you feed a pig " with madder for some time, and then leave it off a " considerable time before you kill the animal, you will " find that the above appearances still subsist, with this " addition, that all parts of the teeth which were form- " ed after leaving off feeding with madder will be " white.

" Here, then, in some teeth we shall have white, " then red, and then white again; and so we shall " have the red and the white colour alternately through " the whole Tooth.

" This experiment shews, that the Tooth once tinged " does not lose it's colour: now as all other bones that " have been once tinged lose their colour in time, when " the animal leaves off feeding with madder (though " very slowly), and as that die must be taken into the " constitution by the absorbents, it would seem that " the Teeth are without absorbents as well as other " vessels.

" This shews, that the growth of a tooth is very dif- " ferent from that of all other bones. Bones begin at " a point, and shoot out at their surface; and the part " that seems already formed is in reality not so; for it " is forming every day, by having new matter thrown

from nerves passing through it, or whether it is a medium of communication to the vascular pulp, I leave others to decide; suffice it to say, that when operating on this substance great pain is sometimes felt; and if we destroy the nerve and pulp, thereby cutting off all commu-

" into it, till the whole substance is complete, and even " then it is constantly changing it's matter.

" Another circumstance in which teeth seem different " from bone, and a strong circumstance in support of " their having no circulation in them, is, that they ne- " ver change by age, and seem never to undergo any " alteration, when completely formed, but by abrasion; " they do not grow softer, like the other bones, as we " find in some cases, where the whole earthy matter of " the bones has been taken into the constitution.

" From these experiments it would appear, that the " teeth are to be considered as extraneous bodies, with " respect to a circulation through their substance; but " they have most certainly a living principle, by which " means they make part of the body, and are capable " of uniting with any part of a living body, as will be " explained hereafter: and it is to be observed, that the " affections of the whole body have less influence upon " the Teeth than any other part of the body. Thus, " in children affected with rickets, the Teeth grow " equally well as in health, though all the other bones " are much affected; and hence their Teeth being of a " larger size and proportion to the other parts, their " mouths are protuberant."

nication to the sensorium, and recommence our operation, the pain no longer exists. The shape of this substance corresponds exactly to the shape of the tooth, and when we remove the enamel, the part beneath has the same edges and same form as if it remained.

The bony part of a tooth is but small at the time of its formation; but, as by the attrition necessary in mastication the enamel becomes worn, an accession of new matter is going on, rendering this bony part thicker, and apparently firmer than it originally was; and when the teeth are wanting, or fall out, the juice destined for their nutrition is conveyed into the empty socket, and fills it with a hard substance, the flesh of the gums at the same time being rendered harder, that it may in some measure supply the place of teeth.

A vulgar opinion prevails with some, that whenever the enamel of a tooth is cut away or knocked off, a decay must take place in consequence of it. This is quite erroneous. We may file the enamel of a tooth, and not do it the least injury; and when a caries takes place between two teeth, we file away the diseased part, consisting of enamel and bone, and leaving the part with a suitable surface, the

decay discontinues. Mr. Fox, in his Treatise on the teeth, tells us, that the inhabitants of some Eastern nations file away the sides of their front teeth, and leave them with a pointed edge; this does not cause them to decay. On this species of bone, I trust that I have said enough to prove that it it well worthy of attention; but many clever anatomists with whom I have conversed, imagining that it possessed the same properties as common bone, have endeavoured to persuade me that decays originated from loss of enamel; nor have I been able, after referring them to the works of celebrated Authors, to induce them to give up their argument.

The fangs of the teeth correspond with the Alveoli of the Jaw bone; and between these Alveoli and fangs is an internal investing membrane, or Periosteum, and this membrane is firmly attached to the roots of the Teeth, but may be separated from them by maceration. Here it is evident that the bone of a tooth possesses some life, for the Periosteum is firmly attached to it.

A tooth may be extracted from the head of one person and inserted into the socket of another, who has had a corresponding one just

drawn; and if the vessels of the periosteum are fresh and bloody, and the patient into whose mouth it is to be put healthy, it will firmly adhere. This operation was frequently performed years ago; but many alarming symptoms having followed it, although the greatest care was taken to procure teeth from persons free from disease,* it is now almost

* Hoping to deter my readers from transplanting teeth into other persons' mouths, I think it necessary to select one instance at least of it's baneful effects, and accordingly choose one from the Medical Transactions, communicated by Dr. Watson, and read at the College of Physicians on the 28th of May, 1785.

"A young unmarried woman, aged about twenty-
"one, of a delicate habit, but in other respects in per-
"fect health, had the misfortune to have one of her In-
"cisores of the upper jaw become black and carious.
"This she determined to have removed, and to be re-
"placed by a sound tooth. It was accordingly done by
"an able dentist, the tooth to be transplanted being ta-
"ken from the mouth of an apparently healthy person
"in every particular. The new tooth fitted exactly,
"and fastened exceeding well; so that the dentist, on
"account of its firm state, removed the silk employed
"to fasten it to the neighbouring teeth sooner than he
"was accustomed to do.

"Things passed on apparently well for a month, the
"new tooth continuing firm: the patient, however, ob-
"served that her mouth felt tender all that time, but

forgotten. John Hunter and others have transplanted teeth into the combs of cocks,

" this she considered as a necessary consequence of the
" late operation. At the end of a month, or thereabouts,
" her mouth became very painful; her upper gums
" were at first inflamed and enlarged; afterwards they
" were discoloured and ulcerated, the ulceration spread-
" ing very fast, insomuch that the gums of the upper
" jaw were corroded away, and the alveoli left bare.
" Before another month was at an end, the ulceration
" occupied the whole space of the upper lip between the
" teeth and the nose; it extended likewise to the
" cheeks and throat, which were corroded with large
" and fœtid ulcers. Soon after this, part of the alveoli
" of the upper jaw became carious, one of her teeth
" dropped out, and, in a few days, a second tooth, to-
" gether with the transplanted one, which had hitherto
" remained firm in it's place.

" About this time, blotches appeared in her face,
" neck, and various parts of her body; several of these
" became ulcerated sores, and being very painful, heigh-
" tened the distress of her calamitous state.

" For a considerable time, the attending to the copi-
" ous fœtid discharge from her mouth and throat had
" deprived her of sleep; and the soreness of these parts
" had prevented her taking sufficient nourishment.
" Added to these, the irritation from the external ul-
" cers heightened a fever, began before, to such a de-
" gree, that her death was soon expected from the dai-
" ly diminution of her strength.

" In this state of the disease, my assistance was de-

and the teeth have firmly adhered, without suffering the slightest change. If we endea-

"sired. She had for some time been under the care of "the dentist; but when matters grew more serious, "she was removed from the country into the neigh- "bourhood of London, that she might have additional "help. She was accordingly put under the care of an "able and experienced surgeon, who exerted his ut- "utmost for her relief. He directed remedies for the "ulcerated mouth, gave her bark in decoction and sub- "stance, as much as her bowels and stomach would "bear, together with anodynes occasionally; never- "theless, the ulcerations in the mouth and throat, as "well as those in various parts of her body, grew worse.

"Upon my being consulted, finding all her juices in "a most putrid and acrimonious state, bark combined "with myrrh, in liberal quantities, both, by experi- "ence, being found most powerful antiseptics, were di- "rected, together with asses' milk. These were con- "tinued four or five days; not, indeed, in the quantity "that was wished for, which her greatly enfeebled sto- "mach would not allow her to take. More, therefore, "could not be done on this plan; neither did what she "had already taken appear in the least to lessen the "disease, by correcting the violence of it's acrimony.

"Another powerful alterative, mercury, was there- "fore determined to be tried. A scruple of calomel, "made up with rob sambuci, was formed into ten pills; "and one of these was directed to be taken once or "twice a day, as her bowels would admit. Of these "she took about fourteen; when, on account of a se-

vour to insert a tooth not partaking of life, (I mean one that has been out of the mouth

" vere griping and purging, scarcely mitigated by tinc-
" tura thebaicæ in large doses, they were desisted from.
" During the taking of these, however, the ulceration
" of her mouth and cheeks did not spread, but were
" less painful, and of a milder appearance; the blotches
" in her face and body grew paler, and such of them as
" had ulcerated healed apace, and no new ones appear-
" ed; hence it was apparent that mercury was the pro-
" per corrector, the true alterative, in this case. Her
" bowels, however, would bear no more, taken by the
" mouth. Unguent cæruleum fortius was therefore di-
" rected to be well rubbed into her legs and thighs twice
" a day, and in small doses: lest in her present debili-
" tated, and almost exhausted state, the mercury should
" be determined to the bowels, and sink her by the eva-
" cuation. In about ten or twelve days, the griping
" and purging returned with violence; the ointment,
" therefore, was discontinued. The good effects of the
" mercury were, however, very apparent, as at this
" time the blotches were all gone; the ulcerations in
" her face and body were completely healed, and those
" of her mouth nearly so. Nor, during this part of her
" treatment, did it appear that the mercury took to her
" gums and salival ducts in the least, an event much to
" be dreaded.

" At this period, from her long continued and painful
" sufferings, want of sleep, and being very imperfectly
" nourished, she continued in dangerous circumstances;
" being exceedingly enfeebled, labouring under fre-

some time) into any part of a living animal, it will not become firm and fixed: and if the

"quent returns of feverish heat, and every night op-
"pressed with colliquative sweats. To obviate these,
"she returned to the use of asses' milk, and other res-
"toratives, and took as much decoction of bark as her
"stomach and bowels would bear. As the weather
"was fine, she was frequently, as her strength would
"permit, taken a few miles in a carriage. During the
"period of her illness she became deaf in a great de-
"gree; and it must not be omitted, that at times seve-
"ral small portions of carious alveoli exfoliated, and
"came away with the sloughs.

"By the means just now mentioned, the symptoms
"grew milder, and she recovered some degree of
"strength. As her usual residence was about eighty
"miles from London, she much wished to return thi-
"ther. This was acquiesced to, as a change of air bid
"fair to assist her; but she was directed to proceed by
"short stages only, as her strength would bear. As
"soon as she got home, a continuation of decoction of
"bark, asses' milk, and other restoratives were advised;
"together with a return to small doses of mercurial
"ointment, when her health was sufficiently recovered
"to permit it. This was strongly enjoined; for though
"the symptoms for which the mercury had been direct-
"ed were totally subsided, nevertheless the quantity,
"internally and externally administered, had, on ac-
"count of her weak state and irritable bowels, been
"but small, when the magnitude of the disease for
"which it was directed is considered. Experienced

experiment be tried in the socket of one just extracted, there will be a disposition in the

" practitioners are not to be informed, that to prevent a " return of those diseases for which mercurial altera- " tives are particularly administered, they should be " persisted in for a considerable time after the symp- " toms have disappeared.

" Upon her return into the country she became no " better; without any new complaints, her strength " gradually lessened, 'till death put an end to her suf- " ferings. Her dissolution was probably hastened by " the unexpected death of a near relation, who lived in " the same house with her.

" It is singularly remarkable, in the history of the " disease just now related, that a tooth drawn from an " apparently healthy young person, and inserted into " the jaw of another healthy young person of irre- " proachable conduct, should have such baneful effects, " and convert the juices, first of the parts near the in- " sertion, and afterwards of the whole habit into a pu- " trid corroding sanies. At first, and even for some " weeks, the contaminated cause operated gently, and " a tenderness in the gums only was perceived; but af- " terwards, as is before mentioned, its operation was the " most active and virulent I had ever seen in any disor- " ders at all similar to this.

" The progress of this putrid disease not being imped- " ed by the most powerful antiseptics in liberal doses, " and its giving way to mercurials even in small doses, " cannot but furnish room to suggest that the taint was " truly venereal. I am well apprised of the subtilty of

socket to fill up; but this does not occur when a fresh tooth, with its periosteum about it, is

"animal poisons; and that from an exceedingly small "quantity of the contaminating cause, the venereal, as "well as the variolous affection, may be produced.

"The dentist informed me, that the person from whom "the tooth was taken was perfectly well, and had never "any venereal taint; but admitting that the pudendum "and its neighbourhood had been affected, the gums "and teeth, from observation, were perfectly sound; "and under that circumstance, it is difficult to imagine "how mischief could arise from thence.

"It is well known, that the diseased part of an infect- "ed person coming into close contact with a tender and "delicate part of a sound person, can produce a disease; "but how an uninfected part, even of a diseased person, "can convey contagion, is not easy to be conceived. "Admitting, for the sake of argument, but which I do "not believe, that the young gentlewoman, the subject "of this paper, had received the infection in the usual "way, it would not have had so violent an effect on the "mouth, and left the pudendum free.

"Upon a subsequent and more particular inquiry of "the dentist, he informed me, that the persons from "whom the teeth to be transplanted are taken, are al- "ways examined by others as well as by himself, with "regard to the state of their health. That, in the case "before us, the young woman from whom the tooth was "taken was strictly so, both as to the tonsils and pu- "dendum, being inspected by an eminent surgeon with- "out the least appearance of disease. In whatever

transplanted. This is a clear proof that any extraneous foreign body, which has not in itself a vitality, will not become connected to a part possessing life. Now, if we consider common bone, and then consider the bony part of a tooth, a very wide difference will present itself; and taking a retrospective view of the human body, and endeavouring to draw a comparison between a tooth and any other part, we find a difficulty in so doing, but in the brute creation same analogy may be found. Mr. Charles Bell has perhaps paid more attention to these organs than any present Physiologist, and has come to this conclusion; "That the vascularity of the periosteum surrounding the tooth, and the vessels "entering by the fangs to its cavity, seem a "provision for supplying it with blood; but "on further examination it will prove to be

"manner, therefore, we search for the cause of this "malady, difficulties, to me at least, insurmountable pre-"sent themselves. I have thought it expedient to lay "down the whole history of the case, that persons con-"versant with matters of this sort, may themselves de-"duce such conclusions from it as they apprehend will "carry the greatest degree of probability of their being "well founded."

"a means of only fixing the tooth in the sock-
"et, and of preserving the sensibility of the
"nerve in the cavity of the tooth. As the
"bony part of a tooth has often been coloured
"by feeding young animals with madder, it
"might deceive some to suppose that there is
"blood circulating through the body of the
"tooth, and that it undergoes the same chang-
"es by absorption as the other bones are
"proved to do. But these experiments may
"have been made while the teeth were form-
"ing by a secretion from the pulp, and of
"course they might be coloured without the
"experiment affording a fair proof that circu-
"lation continues in them after they are form-
"ed. The phenomena displayed in the for-
"mation, adhesion, and diseases of the teeth,
"shew them to be possessed of life, and they
"have a correspondence or sympathy with
"the surrounding parts. But we are prepar-
"ed to acquiesce in the opinion of Mr. Hun-
"ter, that they possess vitality, while yet
"they have no vascular action within them.
"We naturally say, how can such a vitality
"exist independently of a circulation? But
"there are not wanting examples of an ob-
"scure and low degree of life existing in ani-

"mals, ova, or seeds, for seasons, without a cir-
"culation; and if for seasons, why not for a
"term of years? We never find the animal
"economy providing superfluously; and since
"there is no instance to be observed, in which
"they have shewn a power of renovation, why
"should they be possessed of vascularity and
"action to no useful end? All that seems ne-
"cessary to them is, that they should firmly
"adhere without acting as a foreign extrane-
"ous body to the surrounding parts, and this,
"vitality without vascular action seems cal-
"culated to provide."

THE FORMATION

OF

THE JAWS.

If we examine the jaws of a fœtus three or four months after conception, we see them distinctly formed, but in the place of sockets there is a fossa, with ridges projecting across, pointing out the positions of the future alveoli. These ridges, which are to become future alveoli, extend upwards from the internal side of the anterior and posterior plates of the imperfect alveoli; and as the growth of bone goes on, these ridges increase in size, meet each other, and become firmly united.

The grooves at the anterior part of the Jaws are at this time narrow and very deep, but corresponding to the Molar teeth they get wider, and their depth decreases. No distinct canal for the passage of the Maxillary vessels and nerves is at this time formed, but there is a groove at the bottom of the fossa indicating their course.

Small foramina are perceptible all around, indicating the passage of vessels, &c.

The socket for the last Molar Tooth is situated on the inner side of the root of the Coronoid process, and as the bone increases in size, it's situation comes gradually more forward.

The diminutive capacity of the Jaws of a child, their subsequent increase, and the exigencies of teeth, impose the necessity of two sets, a small one which appears shortly after birth, and a secondary set which come afterwards, one by one, protruding from the bone as it increases in size and is capable of containing them.

Instances are on record of infants being born with teeth, but as for some time after birth they live on suction, there is no necessity for them. As the child increases in size, the primary set make their appearance; and, as we have before explained, the secondary permanent set follows, supplying the exigency of nature, being larger and stronger, with long roots to fix them firm in the head, and the Jaws are by this time large enough to contain them.

THE

RUDIMENTS AND OSSIFICATION

OF THE

PRIMARY TEETH.

In a fœtus of five or six months, on opening the Jaw, we see several substances, the rudiments of future teeth. On examination, each is found to be a pulpy substance contained in a sac, and lodged in the Alveolar grooves under the vascular gum, and connected to it.*

To view the pulps, we must cut open the capsule investing them. We find them of nearly the same shape as the teeth about to

* "Maxillis infantis, præmaturè nati, quatuor circi-
"tèr menses in utero gesti, inspectis, rudimenta vel sac-
"culos duodecim dentium, se, omnium dentium decidu-
"orum, necnon molarium anteriorum immutabilium in
"utrâque maxillâ inveni. Omnes hi sacculi satìs dis-
"tincti fuerunt; eosque inter, et genciviæ partem in-
"teriorem tàm arctus intercessit nexus, et indè origi
"nem derivare viderentur; et unà cum eâ sine vasis,
"nervo, etc. quibus adhæserant, e sulco in maxillâ ab-
"rumpi possunt."

be formed. At this time they are gelatinous, and of rather a firm consistency, each being contained in a capsule peculiar to itself.

In a short time these pulps increase in size and get much firmer; and in the course of a few weeks, a blood-vessel shoots across the surface of the one that is first to pierce it's way through the gums. It's vascularity increases, it grows larger, and a curious appearance soon presents itself. A thin shell of bone is found to be deposited by the pulp on it's extreme point, and the pulp itself increases in size.

In the Incisores, ossification commences at three points; and in each of the other teeth, with points agreeing with the number of future points that are to be found in the teeth.*

* "Ossificatio incipit in summo puncto, vel punctis "acierum discindentium, vel superficiorum earum mo- "lentium; et fot in punctis quot sunt in pulpo eminen- "tiæ. Hæc puncta versus pulpum concava sunt et "paulatim aucta parvas elasticas testas super eum "efficiunt. Super incisores, et cuspicates, quorum "formatio reliquorum simplicior est, in singulis una "testa; sed super molares plures formantur. Super "anteriores, vel parvos molares, plerùmque quatuor, "interdùm tantùm duæ observantur. In posterioribus

As ossification advances, that part of the pulp is most vascular which is covered with bone: and the small osseous portions increase in size, gradually unite, and form one thin layer of bone, which spreads itself over the surface of the pulp, and downwards towards the neck of the tooth.

Ossification is now considerably advanced in all the pulps; and in a full grown fœtus, on each side of each jaw, there ought to be the outer shells of the five Milk Teeth, besides the rudiments of the first Permanent Molaris.

The shell of bone we have been speaking about, is loose on the surface of the pulp, may easily be separated from it, and is the outer

"vel magnis molaribus plerùmque inveniuntur quinque "testæ; quarum in maxillâ inferiori, tres extrinsecùs, "vel buccam versus, et duæ internè sitæ sunt. In max- "illâ superiori, quamvis idem testarum numerus sit, "non æquè regularitèr disponuntur; adèo ut earum "eminentiæ priorum concavis respondeant. Ossifica- "tione progrediente, harum testarum bases ad sese in- "vicèm accedunt; et tàm perfectè conjunguntur et "eadem testa fiant. Posteà ossificatio ut in simplici- "oribus dentibus, sc incisoribus et cuspidatis aliquam- "diù procedit."—Disputatio Medica Inauguralis, pagina 10 et 14.

layer of the bony substance of the tooth; and a further examination leads us to conclude, that this bone is formed of successive layers of matter thrown out from the surface of the vascular pulp.

Ossific matter still continuing to be thrown out, the pulp contracts to form the neck of the tooth, and its body is pressed against the top of the socket, and begins to push its way both through it and through the gum.

We have spoken of no pulp corresponding to the roots of the teeth; as yet there has been none: but the bony deposit having increased in thickness, the pulp is forced downwards into the socket, becomes elongated, assumes the position and shape of the respective fang, and the socket accommodates itself to the form it puts on.

Where there are three fangs, as in the Molares, the base of the pulp divides, and three processes of it appear to converge from the centre, forming vascular beds on which the roots are soon to be deposited. The ossific matter increasing, becomes soon moulded round this bed; and the bone uniting at the commencement of the fangs, three tubes are formed with an opening each into the cavity

in the interior of the tooth, and the pulp consequently is greatly diminished.

At this period, the part of the root formed is thin, and the foramen at it's bottom large; the bony part, however, goes on increasing in thickness, and as we advance in years only a small canal remains in the root, and the cavity in the middle of the tooth is materially diminished, for the pulp, wasted in forming bone, scarcely exists. But if we look at the tip of the root, we can just perceive a small foramen, through which vessels still pass.*

The pulp of a tooth may be easily injected; and if we examine growing teeth of large graminiverous quadrupeds, their vascularity is very evident.

The small arteries supplying the pulp are dental branches of the Internal and Inferior Maxillary.

* This small foramen does not close, vessels pass into it as long as the teeth exist; and Mr. John Hunter tells us, that he has been able to inject vessels in teeth of very old people, when the alveolar process has been gone, and the teeth have become loose in the head.

THE CAPSULE,

INVESTING THE PULP.

The Capsule, or sac, which invests the pulp upon which the bony part of the tooth is formed, is well worthy of notice, as it deposits the hardest substance in the whole body, viz. the enamel of the teeth.

We have mentioned, that the enamel consists of Carbonate of Lime, and Phosphate of Lime, but that authors have attributed its peculiar hardness to Fluat of Lime, which is said to exist in it. It is wonderful, therefore, that from this Capsule a juice should exude, crystallize, and become a hard substance like the enamel.

The Capsule* is delicate and thin, but is

* "This membrane adheres by its outer surface all "around the bony cavity of the Jaw, and also to the "gum where it covers the alveoli.

"When the pulp is very young, as in the fœtus of "six or seven months, this membrane is pretty thick "and gelatinous. We can examine it best in a new-"born-child, and we find it made up of two lamellæ, "an external and an internal. The external is soft

divisible into two lamina, the external of which is spongy and somewhat vascular, adhering to the gums: while the internal is smoother and firmer than the former, extremely vascular, and is attached to the base of the Pulp. It receives its vessels from the gums, and in shape resembles the Tooth it incloses.

After the bony part of the tooth has advanced towards it's perfect form, from the internal lamina of the Capsule investing the pulp, a juice is continually exuding, but in a very small quantity, this being destined for the formation of the enamel. A viscous fluid, resembling synovia, is found to exist between the Capsule and the bony part formed, similar to the synovia of joints; and some authors tell us, that this fluid, by the absorption of the thinner parts, becomes inspissated to a proper state for crystallization, so as to form the

"and spongy, without any vessels; the other is much "firmer, and extremely vascular, it's vessels coming "from those going to the pulp and body of the tooth. "While the teeth are within the gum there is always "a mucilaginous fluid, like the synovia in joints, be- "tween this membrane and the pulp of the tooth."— John Hunter on the Teeth, page 87.

enamel which adheres to and covers the crown of the tooth.

Other eminent physiologists imagine, that the enamel is not produced by the concretion of this fluid, but that the secreting surface changes the nature of it's action when the outer layers of the bony part are formed.

The enamel does not acquire it's firm consistency 'till it has been deposited some length of time. Herissant tells us, that this fluid, although at first delicate, quickly thickens, and that, viewing it through a microscope, it appears composed of little vesicles containing a limpid fluid; and that from this fluid, exuded from the surface of the tooth, the enamel is afterwards formed. The attachment of the enamel to the bony part of the tooth makes this appear very probable; and, if we examine the minute connection between these two substances, it must strike us as strange, that after the osseous layers are deposited and become hardened, that the enamel should begin to be formed, make it's appearance, and become inseparably united to the bony part. But if we reflect on the former theory, and the experiments made by Mr. Hatchett, proving that Phosphate of Lime is contained in

synovia, then we can with facility account for the manner in which the union is effected.

John Hunter tells us, that the enamel is perhaps secreted from the capsule; and that it is a calcareous earth, probably dissolved in the juices of our body, and thrown out from these parts, which here act as a gland. Thus we find the nature of the capsule very interesting; and we still perceive, that it is the principal agent instrumental in forming the enamel.

The bony part composing the crown of the tooth being now formed, as well as a part of the root, and the enamel being moulded on it, it forces it's way upwards through the capsule and through the gum,* and these two afterwards become intimately connected.

* "Ossificatione in rądice, vel radicibus progrediente "dentis corpus in præsepiolo elevatur; ideòque mem- "brana, id investicus simùl cum eo ascendit. Cortex "striatus in aciebus discindentibus vel eminentiis den- "tis primus perficitur et inde ad cervicem, ubi termi- "tur, gradatìm progreditur. Et prout prima cortices "striati pars perficitur, ea membranæ portio tenuor, et "minùs vasculosa, sit: quumque munere suo functa "fuerit paulatìm ex toto dispenditur. Hoc dispendium "participare incipit gingiva: et dens sensìm per eam "emergit. Membranæ pars dentis corpus adhùc in-

"vestit, et unà cum eo ascendit; sed prout cortex "striatus quem tegit, perfectior sit, membrana consu- "mitur: adèo ut omnis ea pars, quæ dentis corpori "laxè circumdata erat, cum dens justam altitudinem "altigerit, delctur. De Lasonne, aliique physiologi, "cur dentes emergant, et gingivam penetrent, rationem "reddere conantur, dicendo; prout radiecs adduntur, "dentium corpora, quoniam ginciva imis præsepiolo- "lum partibus mollior est, per eam elevari vel protudi: "sed cum de dentibus immutabilibus agetur, quàm lu- "lubrico solo hæc theoria innitatur, constabit."—Dis. Med. Inau. p. 24.

OF THE DIFFERENT TEETH.

The teeth are thirty-two in number, viz.

Eight Incisors, or Incisores; four Canine, or Cuspidati: eight small Molar teeth, or Bicuspidati; eight large Molar teeth, or Molares: and four Wisdom teeth, or Dentes Sapientiæ. The Wisdom teeth are considered by some as Molares, making three on each side of each jaw; but they are neither as large nor as active in mastication as the two preceding them. We now must describe each tooth according to its shape and appearance.

The Incisors

Are situated at the front of the mouth, four in the Upper Jaw and four in the Lower. Those in the upper jaw are much the largest. They derive their name from the Latin word *incidere*, to cut, for which purpose they are very well adapted.

They are convex anteriorly, and concave posteriorly; their inferior edge is sharp and

cutting; their roots are long, but they allow of a slight motion when we close them together.

If we view them posteriorly, we perceive their internal edge very pointed where it joins the inferior one, and it likewise proceeds up in a more slanting direction to the neck than the external edge, which has its angle more obtuse. By this means we can with facility distinguish one from another. The inferior Incisor teeth are much smaller than those in the upper jaw, and have the same characteristic marks. The Incisores may be compared to wedges with their posterior surfaces somewhat hollowed out.*

* "From this position in the jaw, the upper incisor "teeth project more than the lower, and in chewing "their edges do not meet. They pass each other so as "to cut, and yet do not meet; this prevents the rapid "wasting of the edge that would otherwise take place, "as we see in the horse. The incisor teeth of the horse "being subject to attrition, have a provision against "this, in the cavity lined with enamel, which is ob-"served in their centre; nevertheless, we see them worn "down even below the bottom of that cavity; thus "the surface of the tooth is loose, and the horse has lost "his mark. In some animals, as in the rodentia, the "front teeth are still better formed for cutting; but as

The Canine Teeth, or Cuspidati.

The Canine teeth are four in number, situated one on each side of each jaw. They are called Canine from their supposed resemblance to that tooth in the dog, and Cuspidatis from the Latin word *cuspis*, a point.

This tooth may be compared to a large Incisor somewhat rounded, with its corners filed off. Those in the upper jaw are more pointed than those of the lower, and may easily be distinguished from them by the manner in which they are worn by attrition. Like the Incisors, they overlap the corresponding teeth below, and consequently pressure falls anteriorly on one, and posteriorly on the other.

The fang of this tooth is very erroneously

" they suffer attrition, and in order to preserve the outer " edge sharp, they have a peculiar structure. They " are so deeply socketed, that they reach the whole " length of the jaw, and they are provided with a con- " tinual growth from behind, which pushes the tooth " out in proportion as it is worn away on the fore part. " The enamel in these animals is more accumulated on " the anterior edge of the tooth, so that the edge stands " up fine and sharp."—Bell's Anatomy, p. 9.

supposed by some people to extend as high up as the orbit. When this tooth is much de cayed, or extracted, a pain is felt in the eye, caused by the Infra Orbitar nerve sending down, whilst in the canal, a small filament which enters the root of the tooth.

Mr. C. Bell tells us, "that in the large car- "nivorous Mammalia, this order of teeth are "of terrifie length, whilst the front teeth are "small and curved. The spiral tusk of the "narwhal. and the tusks of the walrus, belong "to this division of the teeth; so does the "tusk of the barbaroussa, which projects in a "spiral direction. The use of the teeth, "Blumenbach cannot comprehend; but Sir "Everard Home conceives, that they are "provided to defend the eyes of the animal "as it rushes through the underwood. There "is a a small imperfect tooth called the tusk, "in a horse, which belongs to this order of "teeth, as it is placed betwixt the Incisors "and grinding teeth.

The Bicuspides, or Small Molar Teeth.

These teeth derive their name from the Latin words *bis* and *cuspis*, owing to their

having on their crowns two small points. They are situated between the Incisor and Canine teeth, and are eight in number, two on each side of each jaw.

They bear a resemblance to two Canine teeth joined together, the internal one being shorter than the external; and, viewing the mouth laterally, the external one only is seen in the lower jaw.

The Bicuspides of the upper jaw are thicker than those of the under jaw, and the internal point is likewise much longer; this is the distinction between them.* The first of the small Molar teeth bears so strong a resemblance to the second that it is difficult to distinguish them, being near the Canine teeth; the first, however, is smaller, and resembles it much more than the second one does.

* The Bicuspides, and especially the second of them, in both jaws, are oftener naturally wanting than any of the Teeth, except the Dentes Sapientiæ. Hence we might conjecture that they are less useful; and this conjecture appears less improbable, when we consider, that in their use they are of a middle nature between cutters and grinders; and that in most animals, so far as I have observed, there is a vacant space between the cutters and grinders.

The Biscupides are of little service in the mastication of the food.

The Molares, or Grinders.

The word Molaris derives it's origin from the Latin word *molare*, to grind, it being between these teeth that the food is broken down and prepared to be acted upon by the solvent power of the Gastric juice in the stomach.

The Molares are situated behind the Bicuspides, and, if we reckon the Dentes Sapientiæ as belonging to them, they are three in number on each side of each jaw.

All the Molares bear somewhat of a resemblance to each other, but we can always detect to which part of the jaws they belong. They are twice the size of the Bicuspis, and are furnished with more roots, and with more points on their crowns.

The Molares of the Lower Jaw are of an oblong square form, with four, and sometimes five distinct protuberances, or points, on their crowns; two or three situated externally, and two internally. By this arrangement small cavities are left between each protuberance, and on the crowns of the Grinders of

the Lower Jaw there appear two grooves, uniting in the middle, and crossing each other at right angles.

The body of the Molares in the under jaw appears large, and flattened externally; internally it will be found more rounded and smaller. By this arrangement, we can distinguish a Grinder of the right side of the Jaw from one on the left.

The fangs or roots of these teeth, by which they are held firm in the Jaw, are two in number; they project downwards from the necks of the Teeth, being bent somewhat backwards in their middle. On their anterior and posterior parts they would be flattened, were it not for a groove which extends upwards from the roots, gradually diminishing towards the cervix.

If we cut through the root when this groove is very perceptible, we find in it two distinct foramina, through which vessels and nerves pass; but it appears nevertheless connected by a thin transverse division. When the grooves are not very perceptible, instead of the two foramina, we find a narrow space extending upwards, broadest by a great deal

from the internal to the external part of the fang.

The first Grinder is, generally speaking, larger than the second, and it's roots are further apart; the last Molaris is generally the smallest, but sometimes we find it even larger than the second. It has, properly speaking, but one root, which is short and thick, appearing like two or three united together. This is the general appearance that the teeth in the under jaw put on; but I must observe, that we find many exceptions. I have seen a dens sapientiæ with five roots, and can with confidence mention it, as I was present at the extraction. We must now consider the grinders of the upper jaw.

The Molares of the upper jaw, instead of being of an oblong square form, like those in the lower jaw, are placed in a transverse direction, and resemble a rhomboid with its angles blunted. By this a difference is immediately perceived between a grinding tooth of the upper, and one of the lower jaw. But this is not the only difference between them. The roots of the upper tooth are three in number, two situated externally, and one internally. The fangs of the upper molares

are wider apart than those of the lower ones, and they are likewise rounder and smaller.

The most probable circumstances for the roots being thus situated are, first, that the Alveolar process is not so strong in the upper as in the lower jaw,* that the force applied

* This particular structure in the Alveolar process of the upper jaw is perhaps to give more room for the Antrum Highmorianum. On this supposition, the fangs must be made accordingly, *i. e.* so that they shall not be pushed into that cavity: now, by their diverging, they inclose as it were the bottom of the Antrum, and do not push against its middle, which is the weakest part: and the points of three diverging fangs will make a greater resistance (or not be so easily pushed in) than if they were placed parallel. If there had been only two, as in the lower jaw, they must have been placed opposite to the thinnest part of the Antrum; and three points placed in any direction but a diverging one would have had here much the same effect as two. And as the force applied is endeavouring to depress the tooth, and push it inwards, the innermost fang diverges most, and is supported by the inner wall of the Antrum. That all this weakness in the upper jaw is for the increase of the antrum is probable, because all the teeth in the upper jaw are a good deal similar to those in the lower, excepting those that are opposite to the Maxillary Sinus; and here they differ principally in the fangs, without any other apparent reason; and what confirms this, is, that the Dentes Sapientiæ in the upper

to them is oblique, not perpendicular, and that the roots of all the Teeth are in proportion to the size and the pressure they have to bear.

The points or protuberances on the crowns of the Upper Teeth, are in general four in number, and the depressions are in a more zigzag direction; they follow, however, in a great measure, the direction of the transverse situation of the tooth.

The teeth of the upper jaw project very much beyond those of the lower jaw, but being considerably larger, we soon find them further back in the mouth: and the upper Cuspidatus is situated between its correspond-

jaw do not interfere so much with the Maxillary Sinus.

What makes it still more probable that the two first superior grinders have three fangs on account of the Maxillary Sinus, is, that the two grinders on each side of the upper jaw, in the child, have three fangs, and we find them underneath the Antrum; but those that succeed them have only one fang in the lower jaw, but by that time the Antrum has passed further back, or rather the arch of the jaw has projected, or shot forwards, as it were, from under the Antra; so that the Alvoolar processes that were under the Antrum at one age, are got before it in another.—Hunter on the Teeth, p. 63.

ing tooth below, and the first Bicuspis. The Dens Sapientiæ likewise, of the upper jaw, has it's posterior part situated beyond it's corresponding lower tooth.

From the arrangement we have considered we find the Incisores formed for the purpose of cutting off a portion of any food from it's original mass. The canine teeth of carnivorous animals are for holding fast, and lacerating the prey. Neither the Bicuspides nor the Dentes Sapientiæ are very serviceable in masticating the food, but the Molares are admirably adapted for this purpose; and when their tips by continued attrition get worn down, the enamel corresponding to the grooves is brought into use, and attrition further going on, the cavity in the middle of the tooth fills up to supply in some measure the deficiency.

OF THE FORMATION

OF

THE SECONDARY, OR PERMANENT TEETH.

We have already mentioned, that we find the rudiments of the first permanent Molaris, in a fœtus of seven or eight months, situated in the back part of the Jaws.

From the posterior and under part of each Capsule, a small process, the origin of a new sac, is sent off; and this appears like a filament stretched up to the neck of the sac, being situated between it and the internal alveolar plate of the Jaw.

The sacs increase in size, and their necks become gradually connected, both being as yet under the gum; as the roots, however, of the first teeth increase in size, the sockets

form around them, and the sacs of the permanent teeth become connected to the gums by means of a small foramen situated at their posterior and under part.

The sockets are processes sent forwards from the internal Alveolar plate, and these gradually increase in size and form round the secondary teeth.

Ossification of the secondary teeth is found most advanced at the time of birth, in the front Incisors and the first Molares; and the teeth between these two points appear sooner than those behind.

At the time of birth, small membranous sacs, containing the rudiments of the two last Molares, are very distinctly seen; and ossification afterwards commences on the tips of the pulps within them, being most advanced in those of the lower jaw.

About the fourth year after birth, the bony part of the Cuspidati, first Bicuspis, and first Molaris is considerably advanced, and ossification of the second Bicuspis and second Molaris soon commences. They all now increase in size, and generally about the seventh year the roots of the primary teeth waste, and they

begin to fall out, the permanent ones coming forward in their place.

The Dentes Sapientiæ begin to be formed about the tenth year.

THE FIRST APPEARANCE

OF THE

TEMPORARY TEETH.

The enamel of the front teeth being now formed, and the bony part increasing in length, those most perfect are consequently pushed upwards, and make their way through the Capsule and the gum which covers them.

The period at which the Temporary teeth first make their appearance is very uncertain; it seems, however, to vary according to the strength of the child.*

* " Les dents percent aux enfans plutôt ou plus tard " selon leur force. On on a vu d'un tempérament si " fort qu'ils avoient des dents en naissant. Elles vien- " nent quelquefois à quatre mois et pour l'ordinaire à " six, à sept, et huit ; et il y à des enfans qui no com- " mencent à en avoir qu'à quinze mois et aù dela.

" La première den paroit ordinairement au deveut de " la bouche, à la mâchoire inferieure. Quinze jours ou " trois semaines apres, il en sort une seconde à la meme " mâchoire. Lorsque ces deux petites incisives sont

The celebrated Louis XIV. of France was born with the two anterior Incisors of the Lower Jaw already formed and grown up above the gum. I have likewise been told, that this same peculiarity existed in the mouth of the late Emperor Napoleon at the time he was born.

The first set of teeth are twenty in number, having their roots long in proportion to their size, but smaller than those of the secondary Teeth.

In each Jaw we find four Incisores, two Cuspidati, and two Molares, smaller than the secondary teeth, in order to agree with the dimensions of the Jaws.

The first tooth that makes it's appearance is one of the anterior Incisors of the Lower Jaw; this is in general about the sixth or seventh month after birth, but no dependance is to be put on the time they are to show themselves, as we frequently see some children in whose mouths they have not appeared 'till the

" sorties les deux grandes incisives de la mâchoire su-
" pèrieure se font voir presque en meme tems; au lieu
" que celles de la mâchoire inferieure ne percent que
" l'un après l'ature."—Fauchard, page 31.

tenth or eleventh month after birth. About a fortnight after one Incisor has made it's appearance, another comes foward, two being at this period formed in the Lower Jaw.

The next teeth which make their appearance are the two Incisors of the Upper Jaw; and these, instead of appearing like the former ones, come down nearly together.

The next which follow in order are, the two lateral Incisors of the Lower Jaw; and these are soon succeeded by the corresponding ones above.

After this, instead of a regular succession, we find that the first Molaris comes before the Cuspidatus, and this in general takes place about the sixteenth month, but in the Lower Jaw previously to the upper one.

The Cuspidatus next follows; and lastly, about the beginning of the third year, the second Molaris completes the primary set.

This is a general rule to go by, and the most regular manner in which the teeth pierce the gums; but when we examine a mouth without teeth, it is impossible to say the precise order in which they will eventually grow.

When, however, instead of appearing in a regular succession they deviate from the ge-

neral rule, considerable irritation and pain is said to accompany their exit.

All the primary teeth having protruded the mouth remains in this state 'till about the begining of the seventh year, when the Incisores waste at their roots, get loose, and fall out, and a second set, called by Albinus the Immutabiles, come forward, being adapted to the capacity of the Jaws, which being now proportionably larger, is capable of receiving them.

Had it been destined that children should come into the world with Teeth already formed, it would be impossible for the mother to administer nourishment to them by means of the nipple. But the necessity of Teeth as they advance in age must be evident, and the manner in which they grow is well worthy of admiration. If Teeth were not wanted 'till the seventh or eighth year after birth, then most probably we should have but one set. The difference in size of the two sets, renders it impossible that they should be formed in the same sockets, and hence it is evident why the old ones are destroyed.

OF THE APPEARANCE OF THE PERMANENT TEETH.

The permanent set of teeth having increased in size, and their roots forming, they are gradually pushed upwards; and about this time the roots of the primary set begin to waste, and their sockets to absorb, so that they are loose in the mouth, and appear in a great measure dependent on the gums for support. Anatomists tell us, that the roots of the primary Teeth are not absorbed by the pressure of the permanent ones against them; and this we can conceive reasonable, for the two are separated from each other. At the time, however, that the bodies of the anterior permanent Teeth have acquired their full size, and rise in the gums, both the roots and sockets of the primary set are absorbed to make room for those about to appear.

The appearance of the permanent teeth is as uncertain as that of the deciduous set.

Some instances are known of the first teeth remaining in the head 'till a person has arrived at the age of maturity; even others where they have remained 'till old age.

The usual time at which children begin to cut their teeth is about the seventh year; but this occurs sometimes sooner, and sometimes considerable later.

The anterior permanent Molaris is generally the first tooth to make it's appearance, and about this time the deciduous central Incisor teeth of the Lower Jaw are succeeded by the permanent ones, one of them generally appearing a little before the other.

After the permanent central Incisores of the Lower Jaw have made their appearance, the deciduous ones in the Upper Jaw become loose, and are in a very short time succeeded by the permanent ones.

The temporal lateral Incisores are next removed, and succeeded by the permanent ones.

Instead of the Cuspidatus next following, the first deciduous Molaris loosens, and the first permanent Bicuspis soon appears above the gum.

Those who are in the habit of seeing a

great number of mouths, must sometimes have observed the succession of the secondary teeth to vary; and we frequently find the first primary Molaris in the head of a person arrived at the age of maturity.

The roots of the second temporary Molaris and Cuspidatus next waste, and the second Bicuspis and permanent Cuspidatus soon appear.

The Dentes Sapientiæ seem likewise to vary much as to the time of their appearance. In some mouths we find them all formed at the age of eighteen, and in others they do not grow 'till the thirtieth year, or sometimes even later. When this, however, is the case, we frequently find their exit accompanied with great stiffness of the Jaw and febrile symptoms.

The shedding of the teeth in general occupies a space of about five years, and during this period it is necessary to pay the greatest attention to the child's mouth.

The sockets are capable of contraction and expansion: and if the second teeth have come forward in an irregular manner, by the extraction of one of them now and then, we may greatly remedy the defect; and if we

have properly considered the teeth that ought to have come away, previously to their extraction, the others fall back and become regular.

Irregularities of the teeth are mostly occasioned by pressure being thrown in a wrong direction, and to this the dentist must pay particular attention.

The permanent teeth arise in sockets peculiar to themselves, being divided from the deciduous set, the roots of which are not absorbed, as was formerly imagined, by the pressure on them of the teeth underneath.*

* An opinion has commonly prevailed, that the first set of Teeth are pushed out by the second; this, however, is very far from being the case; and were it so, it would be attended with very serious inconvenience, for were a Tooth pushed out by one underneath, that Tooth must rise in proportion to the growth of the succeeding one, and stand in the same proportion above the rest. But this circumstance never happens, nor can it; for the succeeding teeth are formed in new and distinct sockets, and generally the Incisores and Cuspidati of the second set, are situated on the inside of the corresponding teeth of the first set; and we find, that in proportion to the growth of the succeeding teeth the fangs of the first set decay, 'till the whole of the fang is so far destroyed that nothing remains but the neck, or that part of the fang to which the gum adheres, and

Although the roots of the deciduous set are not in contact with the teeth beneath them, yet a pressure is produced by the increase of the permanent set against the bony partitions, and from thence against the posterior surface of their roots occasioning a slight irritation to the surrounding parts; then the absorbents are in action, and the roots and sockets waste at the same time.

In cases where a permanent tooth has not been formed till very late, we find the primary one in the jaw corresponding to it retaining it's root; and hence it is evident, that the absorption of the fangs and sockets is influenced in some measure by the growth of the tooth beneath.

then the least force pushes the tooth out. It would be very natural to suppose, that this was owing to a constant pressure from the rising teeth against the fangs or sockets of the first set, but it is not so; for the new Alveoli rise with the new teeth, and the old Alveoli decay in proportion as the fangs of the old teeth decay; and when the first set falls out, the succeeding teeth are so far from having destroyed by their pressure the parts against which they might be supposed to push, that they are still enclosed and covered by a complete bony socket. From this we see, that the change is not produced by a mechanical pressure, but is a particular process in the animal œconomy.—Hunter on the Teeth, p. 99.

The necessity of teeth in the mouths of children after they have a little advanced in age must be evident; but were they born with them, it would be impossible for the mother to nourish them by means of her breast.

If teeth were not wanted 'till the seventh or eighth year, then most probably we should have but one set, but the difference in the size of the jaws of an infant and an adult, renders the change which takes place absolutely necessary.

OF TEETH DEVIATING FROM THEIR FORM.

It frequently happens that nature deviates from her general line, and we see teeth, as well as other parts of the body, very curiously formed.

It is a very common thing to see a tooth formed in a very diminutive and strange manner, but if we examine the mouth attentively, we in general find others large, to make up the deficiency; and it appears as if the juice destined to form the one had been wasted in forming the other, or else *vice versa*, the deficiency of the one being made up in the other.

In cases where a primary tooth has been formed very large, it in general remains in the mouth much longer than the usual time; and the secondary one, which ought to take its place, appears frequently on its inner side.

John Hunter tells us of supernumerary teeth; and we have likewise many instances of them related.

Albinus* mentions an instance of a tooth growing between the nose and the orbit; and Hudson, a celebrated dentist, who practised formerly in Dublin, tells us, that he has found teeth situated behind the Dentes Sapientiæ.

While I was prosecuting my anatomical studies, I was struck with the appearance of a Cuspidatus of the upper jaw; it was short, and appeared as if the body of the tooth was in the jaw, and that it was the tip of the root which presented itself. Upon a further examination, I found this verified; and after the cranium and lower jaw were properly macerated and cleansed, I found one of the lower Bicuspides formed in the same manner.

* "Dentes duo inter nasum et orbes oculorum, dexter sinisterque, inclusi in radicibus processuum quibus "ossa maxillaria ad eminentem nasum pertinent. Longi sunt, crassitudinis insignis. Similes maxime canines, ut videri possint ille ipsi esse, non nati. At aderant præterea canini, præter consuetudinem parvi, et breves, suis infixi alveolis. Itaque videantur esse canini novi, qui non eruperint uptote ibi loci collocati, "ubi sunt novi illi in infantibus. Sed quod miremur "sursum directi, tanquam si sint canini novi inversi. "Et ita quoque formati sunt ut, contra quam alii, a "posteriore parte gibbi, ab anteriore sinuati sint," &c. —Academ. Annotat. Liber. I. p. 54.

I have often found the anterior primary Incisores connected together, there having only been a groove where they ought to have been divided. In this case, the two must have been formed together in one capsule.

THE GUMS.

The Alveolar processes and necks of the teeth are covered by a substance called the gums. They are of a firm texture,* of a red

* "La substance qui compose les gencives est ferme "et d'une matière assez dure, elle est beaucoup plus "glanduleuse que fibreuse ; elle est contenue et enve- "loppée entre la peau qui revêt intérieurement la bouche, "et le périoste. Cette même substance est pénétrée et "arrosée par plusieurs vasseaux de differens genres, "par des artères, des veines, des nerfs, et des vaisseaux "limphatiques, presque tous diviaés et multipliés en "autant de vaisseaux capillaires, formés par la contin- "uation des vaisseaux qui se distribuent aux parties les "plus voisines des gencives. Les gencives s'étendent "en chaque mâchoire, depuis la dernière dent du côté "droit, jusqu'à la dernière dent du côté gauche, tant en "la mâchoire supérieure, qu'en la mâchoire inférieure, "soit en dedans, soit en dehors. Elles s'étendent en- "core en dehors sur les côtés et sur le devant, depuis le "colet de chaque dent, jusqu'à la peau qui revét inté- "rieurement les joues et les levres. Les gencives "s'étendent au dedans de la mâchoire inférieure, de- "puis, le colet des dents jusqu'à la circonférence de la "base de la langue, et au dedans de la mâchoire su- "périeure, jusqu'à la circonférence de la voute du pa- "lais."—Fauchard, tome 1, p. 217.

colour, vascular, perforated, and in some measure composed of arteries, nerves, veins, and absorbents; and from these, numerous capillary vessels pass, which open on their surface by minute orifices, discharging a thick mucilaginous fluid, which collects on their surface. Having thus considered their texture, we are not be astonished at the spongy appearance they put on when the blood of the system is in a thick and impure state; by this their smaller vessels become choked up, and circulation through them ceasing, the blood becomes accumulated, they swell, and assume a brown and unhealthy appearance.

At this time a peculiar discharge is given out from them, by which the enamel corresponding to the neck of the tooth becomes much discoloured; and hence it is highly necessary to let out the blood accumulated in them, and resort to friction and the use of astringent tinctures, in order to restore them to their original healthy state.

In their natural state, the gums are of a red colour, and of a somewhat cartilaginous hardness and elasticity; they adhere to the alveolar process, and to the commencement of the roots

of the teeth, although their very edge hangs loose over the top of the enamel.

The gums of the upper jaw extend externally as well as internally round the sockets, as far back as the tuberous process, and slips pass across, connecting them together. In the lower jaw, they are situated on each side of the Alveoli, and extend as far back as the root of the Coronoid process, having the same slips passing across, connecting the external gum to the internal.

Independently of the diseased appearance already mentioned, the gums are likewise subject to other morbid changes; they frequently assume a callous thickening, which sometimes has a cancerous appearance, and we often find abscesses formed in them, their situation being most frequently corresponding to some root which is left in the socket, or to a tooth, not possessing vitality, and acting consequently as an extraneous irritable body.

A healthy state of the teeth depends very much upon the gums, and the gums on the state of the teeth. When they possess their natural appearances, they have not much sensibility; and in the mouths of both children and old people, they act as substitutes for

teeth, and sometimes acquire hardness to such an extent as to suffer considerable pressure without causing pain.

Uses.—They retain the teeth firm in their sockets, prevent the jarr that would without them be occasioned by the under set striking forcibly against the upper ones, they relieve the glaring whiteness of the teeth, and *vice versa*, and by the semicircular manner in which they surround them, give both grace and elegance to the mouth.

OF THE

LOSS OF TEETH.

A caries of a tooth is the most frequent cause producing it's loss, but blows, scurvy of the gums, inflammation of the Periosteum, absorption of the sockets, pains produced by sympathy incident to females during pregnancy, and other causes, very frequently hasten their destruction, or our desire to part with them.

The loss, however, of a tooth, is of more serious importance than we may probably imagine; there is always a disposition in the anterior and posterior, as well as the lateral sides of the socket, to approximate, and the pressure which the extracted tooth bore is thrown upon those contiguous to it; they have consequently to support an additional pressure, and their sockets become much sooner weakened than if the mouth had remained in it's original state.

We may compare a tooth bearing additional pressure, to a piece of iron blunted at

both ends, and driven into a mallet, having a number of other pieces around it not projecting quite so far; now if we strike this mallet against an anvil, (see Notes p. 43,) in different directions, but in a similar manner to the motions of the lower jaw during mastication, it will be perceived, that the socket containing it becomes soon weakened by the pressure, and the protruding piece of iron gets loose and moves about in various directions. It is precisely by the same rules, that a tooth of either jaw bearing an increased pressure soon becomes loosened; and if the absorbents at this period are in stronger action than usual, the sockets are soon partly conveyed away, and the tooth has not much more to support it than the gum. A regular pressure on all the teeth is necessary however to their economy; and we will again consider another reason why the extraction of a tooth should not be resorted to, without it is indispensably requisite. There is likewise a disposition in the sockets to fill up, and this the pressure of the two rows against each other tends to counteract. When a tooth of the under jaw is extracted, the upper one closing in contact with the vacant space lengthens and comes down into it,

its own gravity tending greatly to assist it; and this is very frequently mistaken by the patient for a recession of the gum, or for an absorption of the socket. Sometimes the posterior extremity of the tooth, closing in contact with the space, is pressed on by the anterior extremity of the tooth beyond the one extracted; and by the common laws of pressure, this causes the untouched end to elongate, and it appears to take a transverse direction, gradually coming down into the space mentioned.

Although this does not cause the immediate destruction of the tooth, it destroys its connection to the socket, and lays the foundation for its fall; and thus it will be perceived, that not only are the sockets of the teeth in contact with the one extracted greatly weakened by the loss, but that other mischief is by it conveyed to those in the other jaw.

It may be well worthy of notice, that if a tooth has early in life received a blow, which has loosened or displaced it, and it be properly put again into the socket, and the antiphlogistic regimen adhered to, it will fasten and become serviceable, sometimes retaining its vitality, and at others being discoloured: the

parts around are nevertheless much weakened, and less capable of resisting pressure than they formerly were. In the course, however, of life, most probably between the fortieth and fiftieth year, (sooner or later, according to the extent of the injury,) the socket will become worn out and the tooth loose; and as it moves about in various directions, causing irritation, and inflaming the surrounding parts, it's extraction will soon be found necessary.

Very few people pass through life without losing some of their teeth from decay,* and

* Decays of teeth are of various kinds, and much more intricate than we might at first imagine. They commence principally on the external surface of the enamel, and every substance, solid as well as fluid, which tends to destroy it's attraction of cohesion, and causes it to lose it's crystallized texture, will produce a decay. Decays in general commence by a small dark speck, which goes on gradually increasing. When the bony part is attacked, the progress of the decay is more rapid than before; the earthy hardening part seems first destroyed, and the bone assumes a much softer nature.

There is a kind of decay peculiar to dyspeptic people which commences by a black spot, and gradually eats through the substance of the tooth, causing in it's progress no pain. When it has consumed the whole body of the tooth it suddenly stops, and it leaves the roots in the head covered with a black crust. The

their loss is occasioned by it's eating through the substance of the tooth, and exposing the nerve in the internal cavity. All the teeth in the mouth are subject to decay, but the incisors of the lower jaw are very seldom affected by it. The upper incisors very fre-

change which the decay effects on the nerve, we have not as yet had explained to us, but it entirely deprives it of sensibility. The teeth are likewise subject to another change, which is exceedingly curious; they sometimes appear as if files of different shapes had been employed to cut through them corresponding to the edge of the gum, and that the operation had been left half finished. Two dentists in London, of the greatest celebrity, invariably tell their patients affected in this way, that the disease is produced by the use of tooth-brushes, powders, &c. The late Mr. John Hunter differed from this *philosophic* opinion, he conceived it to be an original disease of the tooth. I have seen the disease assume a zig-zag appearance, exactly as if a worm had eaten it's way along it, corresponding to the edge of the gum; and I have likewise known it frequently occur in the mouth of a person who seldom brushed his teeth, and in such situations in the teeth as the brush seldom gets at.

As it occurs at a particular period of life, and is in a short time effected, as it suddenly stops, &c. it may perhaps depend on the action of the absorbents; and if we examine the periosteum of a tooth, we find it much more firmly attached to the bony part where it meets the gum than to any other which it covers, and this is corresponding to the part most frequently affected.

quently decay, especially if in the mouth of a person subject to dyspeptic complaints, or if they are in too close contact with one another; and as their loss causes great deformity of the countenance, and obliges the person to resort to the use of artificial teeth, a dentist cannot pay too much attention to the operations necessary for preserving them.

When all the teeth have been extracted, the sockets are soon conveyed away, and the lower jaw assumes a very different appearance; a deposition of osseous matter has been going on in the sockets, while at the same time their sides not absorbed have been approaching each other, and thus under the gum we have a ridge of bone formed, which takes a semicircular direction, being high at the anterior part of the mouth, depressed corresponding to the molares, and gradually again mounting up in the coronoid process; the chin is short, and slants obliquely backwards, being little more than about three quarters of an inch deep, whereas in a full-sized lower jaw its depth may be computed at about an inch and three quarters; the sides of the bone, although still of a semi-eliptical shape, are much further apart than they were; the angle of

the jaw is nearer the front of the face than it was, and by this, and the transverse direction that the ascending ramus takes, the Carotids are left almost unprotected. Thus it will be perceived, that the bone has returned to nearly it's original state in the fœtus. By it's little depth, greater exertion is required to bring it in opposition with the upper jaw, and from this arises that peculiar motion of the lower jaw which we see in old people during mastication.

OF DENTITION.

The numberless diseases that children are subject to during the process of dentition, the symptoms with which it is attended, and the foundation that it often lays for destructive diseases, ought to impress upon the minds of all parents and practitioners the necessity of paying great attention to them at this period, which may be justly called very critical, from the variety of sympathetic affections which it gives rise to. Although it would not be proper here to make a distinct inquiry into the nature of each morbid phenomenon of this process, yet we shall allude to those which are known often to accompany it, and mention the palliative mode of treatment generally adopted.

Authors vary much in opinion as to the fatality of teething; some estimate at one in ten, others at one in six or seven; but although many children die during the process of dentition, it should be recollected, that

they are subject at this period to many other diseases, more liable to prove fatal. But it must be admitted, that the process itself has very dangerous consequences attached to it, and tends frequently to rouse up many latent dispositions, which in process of time might have been overcome, or at least not have shewn themselves 'till a more advanced period. By this we perceive, that teething is concerned but in an indirect manner in the great mortality of children, which we have before alluded to.

From the manner in which animals shed their teeth, we might be led to consider dentition as a natural process; but writers, as far back as Hippocrates, tell us, that the most dangerous symptoms arise from it. He himself says, "Πρὸς δὲ τὸ ὀδοντοφυεῖν ἅλων, ὀδαξυσμος, πυρετος, σπασμοι, διαρροιαι, και μαλιστα οταν ἀναγωσι τους κυνοδοντας."*

The process of dentition is preceded by a

* Εν Ιωσικρ. αφορ Τμ 3. αφορ 25. Quamvis enim dentium eruptio naturalis sit et in multis infantibus absque multa molestia contingat in quibusdam tamen gravibus dentitio stipatur symptomatibus, quæ aliquando aliis morbis attribuntur licet a dentitione sola pendeant.—Van Swieten, Lugdun. Batavorum.

variety of symptoms. One of the first signs of a tooth about to be cut is, a heat in the mouth which produces thirst, and causes the child to wish for the breast more frequently than before. This is accompanied by an itching of the gum, when the child, following the dictates of nature, inserts its finger into the mouth, in order to rub the annoying part, and presses the nipple between his little jaws, occasioning severe pain to his mother.

This is in general followed by an increase of saliva from the salivary glands, and it may be looked on in a favourable light. It tends to lessen the thirst brought on by the local inflammation, and the child has, when it is copious, a less desire for the nipple; it diminishes the inflammation and irritation of the gums, and furnishes an additional quantity of saliva, with which the food becomes imbued; and it likewise tends to abate the arterial action which is generally strong during the process of teething.

The next symptom which in general shows itself is, a swelling and redness of the gums, corresponding to the part of the tooth about to appear; they become painful, but suppuration has seldom been brought on in them by a

tooth piercing through their substance. The parts around sometimes, however, sympathize to a very great extent; the Schneiderian membrane of the nose becomes affected, and the child is frequently rubbing it; the maxillary glands are likewise often affected, and if the child is of a scrofulous habit, this has been known to bring on the disease. Fever is likewise very often produced, the body becomes heated, the cheeks flushed, and sometimes eruptions appear on them, and the eyes assume a heaviness caused by the lacrymal gland receiving a branch from the fifth pair of nerves.

If the irritation in the gums be very great, or if many teeth are about to be cut at the same time, there is great sympathy throughout the whole body. The fever is remarkable for it's peculiar rise and fall; at one hour it is very high, at the next greatly abated, but then again shortly returns to it's increased state.

If the symptoms become aggravated, the fever is at times excessive, there is an increased secretion of urine from the kidneys, leucorrhæa in females, great impatience, fretfulness, startings in the sleep, frightful dreams,

spasms of particular parts, diarrhœa, gripings, and a discharge has been known to come from the Urethra resembling gonorrhœa.

Although the above-mentioned symptoms generally accompany difficult dentition, yet we must not always expect them, for some children cut their teeth in such an easy manner, that the process would not be perceived but for the anxiety of the parent on the occasion. Cutting of teeth seems to affect strong and healthy children as well as the weak and delicate. Underwood, in his Treatise on Diseases of Children, says, "Indeed "weak and even rickety children commonly "cut their teeth easily, although very late; "or if they should be harrassed by a purging, "or other complaints, they usually escape "with their lives; while very lusty, strong "and robust children are frequently carried "off suddenly at this period, unless the teeth "happen to find an easy passage through the "gums. The system during teething being "disposed to inflammation, such children "must oftener fall into fever than the tender "and delicate, like robust adults, who are "more disposed to inflammatory complaints "than those of a colder but less healthy tem-

" perament; and it is by acute fever or con-
" vulsion that infants are carried off, who are
" well known to survive a thousand lingering
" and vexatious complaints, if the internal
" parts are sound. It may however be ob-
" served, that convulsions more rarely occur
" where a fever attends."

Teething, although it does not often produce death, yet it excites nervous irritability, brings on fever, as we have mentioned, and of course disturbs the functions of the alimentary canal. A great deal may be said respecting the enfeebled state of the child at the time the teeth are being cut, and hence an early dentition has dangerous consequences attached to it; and if the theories of some authors be correct, as to the Periosteum being the principal seat of pain, and the Molares irritating and stretching it more than the other teeth do, it may appear fortunate that they come forward when the constitution is getting strong, and more capable of resisting the pain. I have, however, seen convulsions and symptoms of sympathy produced by the protrusion of the back teeth.

If the enamel of any of the permanent teeth is being formed at the time a child's

constitution is labouring under any of the dangerous symptoms mentioned, it is in general but scantily deposited, and this is owing to the arteries having to keep up the vital functions. The appearance that it puts on is very strange; little ridges of enamel are found on it, and these surround a part of the bone of the teeth entirely devoid of enamel. Authors have attributed this disease to various circumstances. Blake, in his Disputatio Medica Inauguralis, p. 115, says, "Ad hæc fovearum "rationem reddendam Wooffendale ingenio- "sus chirurgus Liverpoolensis, hæc habet.—I "have been at some pains, and I believe my "endeavours have not been in vain, to ascer- "tain a cause for these appearances.—Hunc "effectum variolis omnino attribuit mox au- "tem ad opinionem non amplius tenendam, "stabiliendam insupèr observat.—I have fre- "quently seen these marks on both the first "and second set of teeth, which causes me to "suspect such children have had the small- "pox twice.—In exemplis quorum mentionem "feci; vitium quoad materiæ ossæ deposi- "tionem certis temporibus in constitutione "fuisse videtur. Sed in aliis exemplis quæ "vero longè numerosissima sunt, ea peculi-

" aris mutatio quæ particulas terrenas ad " crystallisandum proclives reddit, de fuisse " videtur."

Some Authors consider the gums as possessing little or no sensibility, and attribute the pain and constitutional sympathy to the tooth stretching the Periosteum, and forcing it's way through it. The gums by repeated friction may be brought in some persons to an almost insensible state, but we very often find them possessing very great sensibility. They have, however, a vascular action going on in them, and like bones, or any other part possessing vascularity, if irritated, inflammation will be the consequence. The structure of the gums is very firm, but the increase of the tooth by the osseous deposit goes on, and it forces it's way upwards. I do not mean to say but what the Periosteum is much inflamed during the process; but as it's structure is much thinner and delicate than that of the gum, the tooth has less exertion to break through it; and besides, while the tooth is enlarging in it's socket, and stretching the membrane covering it, if this were the case, why should not the same pain and inconve-

nience ensue as does when it arrives at the gum.

Where the opinion regarding the Periosteum being stretched has prevailed, a great deal has been said as to the largest tooth most stretching it, and consequently being productive of the most serious evils. A great many Authors, ancient (Hippocrates among them) as well as moderns, have alluded to the symptoms which occur when the Canine tooth makes it's exit from the socket; but it of course, on account of it's shape, finds more difficulty in doing so than the Incisores, which are of a different shape, with their upper edges sharp, better of course enabling them to pierce through the hard substance of the gum. Again, it is easily perceived by the inflammatory state of the gum corresponding to the tooth about to appear, that it is with it that the sympathy is greatly connected, and instances have been known of suppuration being brought on.

It will be perceived by what has been said, that it is by the constant accession of new matter that the tooth pushes itself up through the gum; and although a little absorption may be going on, yet the principal part falls

back and surrounds the tooth, all the parts going on increasing in size.

It is of the utmost importance during teething to diminish the local irritation arising from the protruding tooth, and if this be kept under, few dangerous constitutional symptoms will arise. The increased secretion of saliva, which commences with the itching of the gum when the tooth is merely stretching it's covering, will always afford a premonitory symptom of what is to take place, and proper means can be taken, by diet, medicines, &c. to keep down inflammatory action. The food of children cannot be too simple, and I have heard it doubted by a very eminent Surgeon, whether dangerous Dentition is most produced by the local irritation, or by a constitutional irritation, caused by an improper change of diet, which parents at this period sometimes accustom their children to. The system during the progress of Dentition is always excitable, and easily roused into a fever, therefore nothing is more destructive than allowing children food that is at all stimulating. Jellies from vegetable substances at this period are very proper and serviceable, such as arrow root, sago, or tapioca, but the stomach

must at no time be overloaded with any substances, however easy of digestion. Great regularity in meals it will be likewise very necessary to attend to; but the power of digestion is greater in some children than in others, and with this the quantity of food should coincide. The head, during the time the process of Dentition is going on, should be kept cool, and washed every morning with cold water. Every thing likely to produce a determination of blood to it should be assiduously avoided, as hydrocephalus, a very fatal disease to children, is often at this period produced.

The belief that the teeth force themselves mechanically through the gums, gave origin to the employment of a coral, and other hard substances, in order to aid the operation; but regarding the benefit arising from it's employment, a diversity of opinions has been given. As soon as the teeth begin to enlarge and stretch the Periosteum, the gums itch, and nature then seems to institute this practice, for the child has a disposition to press every thing that is hard and resisting against the gum. Although the use of coral has a great many advocates, yet I should consider

some softer substance more advantageous to relieve the symptoms which manifest themselves. I would adopt in it's place a small piece of liquorice root, the pressure which can be made with it will be found considerable, and the salivation by which the engorged vessels relieve themselves, will be equally promoted. It would appear, that by continued pressure with the coral the gums become firm and hardened, and when the first symptoms shew themselves it's use is very frequent. Now when the tooth pierces the gum, there is often so much local pain that the child will allow nothing to touch it; the use of the Coral is therefore left off; and although a great deal has been said respecting the part to be pierced being presented between two resisting substances, yet when it is most required it will be seen to be impracticable.

The pain and dangerous symptoms being entirely occasioned by the tooth forcing it's way through the Periosteum and through the gum, very little relief can be afforded by any general applications; but a practice is usually adopted, which, although some people object to, is found to afford the most beneficial results. This is, to make a free incision as

deep down as the crown of the tooth. Many Authors raise objections to this practice, and tell us that the gum is an almost insensible substance, and that little benefit can arise from cutting through it. It is true, that the gum in it's healthy state does not possess very great sensibility, but it is sometimes found very painful and irritable. Some Surgeons think that great difficulty attends the performance of the operation, and that there is danger of wounding some of the arteries going to the Submaxillary or Sublingual glands; but there is a considerable space between the edge of the gum and the fold which binds down the tongue, and the Ranine artery could not possibly be wounded without the operation was performed in a clumsy manner. Scarification of the gums has likewise been objected to from a fear that if the instrument strikes against the enamel a decay would be the consequence; but this is not to be feared. So delightful is it to witness the wonderful relief afforded by this simple operation, that a practitioner who has been in the habit of judiciously performing it is it's strongest advocate; and convulsions, which have endangered the child's life, have been known to cease

immediately the operation has been performed. A great many practitioners have performed this operation with little success, and have perhaps fallen into error from conceiving that the Periosteum was only the seat of pain; others have stated, that no benefit attends it without deep incisions are made all round the surface of the tooth, and every part covering it is completely divided: but the situation and shape of the offending tooth ought to be known, as it is necessary to make incisions adapted to the surface that presents itself. For this I shall give a few directions. If an Incisor tooth is about to make it's appearance, it is necessary, instead of carrying the incision from the anterior to the posterior part of the gum, to make it following the direction of the upper part of the tooth, care having been previously taken to ascertain it's precise situation under the gum, and the incision having been carried deep enough to divide the Periosteum. If a Canine tooth is about to come, it will be necessary to feel for its point under the gum, and make the incision so as to divide the parts immediately above it. If the child should suffer during the time a Molar tooth is being cut, it will be ne-

cessary for the Surgeon to be well acquainted with the points and depressions on it's upper surface. The practice I mentioned of making incisions down to the crown of the tooth, and then carrying them about in various directions, was strongly recommended by a late very eminent accoucher, as he had observed that simple incisions had been productive of no very beneficial effects. On the surface of the Molar teeth there are depressions as well as points; and most probably in the instances not affording relief, the Incisions had been made corresponding to the depressions, and the parts irritated by the points of the tooth were almost unaltered.

A friend of mine had a Dens Sapiens growing in the Jaw, which as it pierced the gums gave pain and uneasiness, the gums around were much swollen, and the muscles of the Lower Jaw exceedingly stiff. I felt for the most prominent part of the tooth, and made two deep incisions down on to the processes, which gave a great deal of pain. Considerable relief followed, and the tooth soon made it's appearance, but in a transverse direction, as is often the case when the mouth is small.

The posterior processes first appeared above the gum, but as the tooth increased in size it pressed against the one before it, and it's anterior part was consequently thrown upwards. The same symptoms which had manifested themselves about two months before now returned; and the same mode of relief was resorted to. This shows that one point of a tooth will cause the same irritation as the whole of it, and this was the opinion of Dr. Underwood.

A necessity of being well acquainted with the shape of the teeth will now be seen; and when that knowledge is acquired, the surgeon will let his own judgment guide him as to the operation. It ought not to be performed with a thin lancet, but with an instrument that will so separate the parts as to leave an union very difficult to be effected. Whatever may be said against scarifying the gums, it is always a safe operation, and the beneficial results and the little risk attending it will always recommend it.

I have heard an eminent surgeon draw a comparison between a tooth piercing the gum and a ball which has been received into any

part of the body; for a long time it remains quiescent, but gradually works its way to the skin, and when arrived there, causes fever and constitutional irritation, as if nature indicated the necessity of expediting it's exit by making an incision down to it.

THE

CONTENTS OF THE MOUTH.

Although the Teeth are the principal organs which present themselves to our view, when we look into the Mouth, it contains others which are of equal importance.

On consideration, perhaps no other part of the same dimensions in the whole human frame contains so many organs, each serving it's separate uses, as the Mouth. The Teeth themselves are distinctly arranged for separate offices, the Incisors for cutting, the Canine teeth for laying hold of and lacerating the prey, and the Molares for bruising and triturating it. Ducts open into the mouth for the purpose of pouring in the saliva which mixes with the food during mastication, and glands are connected with it to supply these ducts. It has several openings, one down the Trachea to the Lungs, for the purpose of respiration; one down the Œsophagus to the stomach,

through which the food passes; one into the internal ear by means of the Eustachian tube, for the purpose of transmitting the waves of sound to it: one from the posterior nares, and likewise the openings of the ducts before mentioned.

It might appear strange, when so many offices are being performed within this small cavity, that one should not interfere with the other; but each part is so arranged as to prevent the inconvenience that such a circumstance would occasion.

The consequences of the food passing the Trachea to the lungs, would be suffocation and immediate death: but this the arrangement of the Epiglottis and Arytenoid cartilages prevents; and when by chance the least morsel or drop passes, as is commonly called, the wrong way, the irritation that it causes is so great as to partly convulse the parts connected, and cause an involuntary cough, which prevents its further progress.

There is likewise an arrangement at the back of the mouth, which prevents the food passing into the nostrils and Eustachian tube. This is effected by means of a muscle called

the Levator Palati Mollis, which pulls up the Velum, and removes it from the way of the food which is about to pass, at the same time forming a curtain, which hinders it passing into either of the passages just mentioned.

Looking into the back of the mouth we see two arches; the first is the Constrictor Isthmii Faucium, and the second the Palato Pharyngeus. Their use is to assist in directing the morsel towards the Constrictors of the Pharynx; between them are the Amygdalæ, or tonsils, and the pendulous substance that we see moving at the back of the soft palate is the Uvala.

The muscles attached to the tongue are likewise very curiously arranged, and connected with the mouth.* There is no part of the human frame capable of so many motions as this organ; and the facility with which they are performed render it a most wonderful contrivance.

From this we may form some idea of the exquisite nicety with which the human frame

* For a description of the muscles of the tongue, see Anatomy of the Human Body, by C. Bell, p. 271.

is adapted; and the more we enquire into the works of nature, the more we find ourselves always led on by an eager desire of obtaining a knowledge of all her wonders.

OF THE

GROWTH OF TEETH

IN

DIFFERENT QUADRUPEDS.

The growth of teeth in some of the brute creation, is too interesting to leave unnoticed. This differs, however, with their formation, which is calculated so as to be subservient to the exigences of their manner of living.

The Squirrel, Dormouse, Rat, Guinea-pig, Hare, Jerboa, Beaver, Kangaroo, and others classed among the Glires or Rodentia, have the enamel of their teeth, greatly accumulated on their anterior surface.

Their front teeth are formed on a pulp of a bent form with it's concavity posteriorly, being deeply socketed in the substance of the Jaw, and reaching nearly it's whole length.

They are provided with a continual growth, which pushes the tooth upwards in proportion as it becomes worn down by the gnawing peculiar to this genus. The anterior surface on which the enamel principally is, being on account of it's hardness less worn, is left with a sharp edge similar to a chisel, so as to be well adapted to gnawing hard substances.

The pulps on which the tusks of the Elephant and Hippopotamus are formed are precisely similar to those which we have just considered; and as the osseous part of the tooth is in a constant state of growth in the socket, it increases internally, and elongates in proportion as the external surface is worn down by attrition.

The Feræ, under which head come Predaceous and Carnivorous animals, such as the Hedge-hog, Mole, Badger, Bear, Opossum, Ferret, Stoat, Dog, Cat, Lion, Tiger, Panther and others, have the osseous part of their teeth formed on a pulp enclosed in it's Capsule, which deposits the enamel as in man, and only differs in shape.

The formation of the teeth of Graminivorous, or Ruminating animals, is likewise very

interesting, the enamel being adapted in a proper manner so as to pervade perpendicularly the whole substance of the tooth, and enable it to resist the attrition peculiar to rumination.

Their teeth are deposited after the same laws as those of the Carnivora and the human species, having a pulp or vascular bed, on which the bony part is moulded, and a Capsule to deposit the enamel.

The pulp consists of several processes united at their base, and the Capsule which encircles it is attached round it, sending down perpendicular lamina between the processes of the pulp, rendering the rudiments of the tooth rather complicated.

By the shape of the Capsule it will be perceived, that the enamel is not only intended to be deposited on the crown of the tooth, but that the lamina, which may be compared to the Pia Mater dipping down between the convolutions of the brain, are intended to deposit enamel which must take the same perpendicular direction.

Before we proceed, it will be necessary to state, that the tooth is composed of three different substances, viz. bone, enamel, and the

third has been called by Dr. Blake, crusta petrosa:* the use of which is to fill up the cavities that would be left between the processes of enamel, and by making the surface

* "Hujus substantiæ (quam distinctionis causâ "crustam petrosam nominare mihi liceat;) usus esse "videtur dentium latera æqualia reddere; et no cortex striatus diffringatur vel nimis citò deteratur, cavere. Superficiem quâ cibus teritur ampliorem et "magis asperam facit. Namque non æquè citò ac pars "ossea, sed quàm cortex striatus citiùs deteritur. Interdum molares sub gingiva, &c. tam diu manent, ut "cava in quæ membranæ ad corticem striatum formandum descenderaut, crustâ petrosâ penè expleantur. "Plerùmque tamen hæc cava, animalis cibo, dentium "inter manducandum fructis, vel sabuli, et argillæ "particulis, replentur.

"Hæc substantia adventitia prorsùs spongiosa, textura "que et coloris a reliquis partibus diversi manet. "Hoc valdè insigne est in ovium dentibus quorum cava "particulis graminis, argillæ, &c. replentur. Alii nec "parvi, momenti, usui inservire videtur crusta petrosa: "quum enim magna pars corticis striati dentis, ut suprà "dictum est, in maxilla lateat; quumque ei membranæ "adhærère non possint, neque alitèr circuitus per præsepiolum fieri possit; deponitur crusta petrosa, cui "adhæreant, ne præsepiola lædantur. Substantiam huic "similem in molaribus elephantis, rhinocerotis, &c. "etiamque in molaribus leporis, &c. observavi."—Disp. Med. Inau. p. 82.

of the tooth even, render it less liable to accidents.

The crusta petrosa being softer than the enamel gets worn down around it, and by this a cavity is left into which foreign matter is introduced by mastication, and this, mixing with a deposit from the saliva, fills up the cavity, and appears like a fourth substance composing the tooth.

If we examine the Jaws of a Calf prematurely born, we find within them the pulps of the Molares, of the form we have already described, with a Capsule inclosing them; their bases being situated deep in the Jaw, and their extremities under the cutting edges of the gums. Ossification commences before birth on the tips of the processes, and the lamina from the Capsule dipping down between them soon afterwards deposit the enamel. The osseous matter goes on increasing in length, and the shells of bone all unite at the base of the tooth, assuming a convulated appearance.

The membrane, or sac, which surrounds the pulp, is divisible into two lamina, the external of which is very vascular, and the internal one appears not to be furnished with

vessels. "Nullum vas sanguiferum internum "intrans animadvertere potui." (Blake, in Disputatione Medica Inauguralis.) As soon as the osseous part of the tooth begins to be formed, the internal lamina of the Capsule secretes a soft earthy matter, which, mixing with a mucilaginous fluid found between this membrane and the shell of bone, becomes thick, crystallizes, and forms the enamel. When bone is mouldered on the conical processes of the pulp, and the enamel is secreted, the pulp elongates to form the roots of the tooth; and the bony matter increasing, the tooth is pushed towards the gum, and the capsule along with it.

As yet only the enamel and bone is forming, and a space is left between the processes totally unoccupied; it is, moreover, necessary that this should fill up, in order that the tooth should pierce the gum in one solid mass. To effect the entire formation of the crown of the tooth before it pierces the gums, the crusta petrosa before alluded to begins to be formed, and it's situation is between the processes of the enamel, being continued high up, making the parts afterwards smooth and even.

When the enamel is deposited from the in-

ternal lamina of the capsule, this membrane changes the nature of its secretion, and from that which is afterwards thrown out this last substance is formed.

The nature of the various substances composing the teeth was overlooked by Mr. John Hunter, although his investigations and theories are in general so accurate and well considered. The circumstances which led him into the error are as follows: in making preparations of teeth of graminivorous animals, in order to shew the extent of the substances composing them, he exposed their surface to the heat of a blow-pipe, and consequently rendered them black; then polishing or scraping the burnt surface, he found the enamel retaining its whiteness, and the other part around it discoloured.

From these preparations it was very natural for him to conclude, that the tooth consisted of but two substances, like those of man; and when he examined afterwards their rudiments in the jaw, he found a pulp on which the enamel was to be deposited, and a vascular membrane passing down between its processes. The pulp and capsule only being seen, and as

this corresponded with the enamel and bone, we can easily conceive the error.

The observations afterwards made by Sir Everard Home on the structure of the teeth of Graminivorous Quadrupeds, which were read before the Royal Society, on the 30th of May, 1799, threw a great light on the subject, and the nature of the crusta petrosa was fully explained. The same doctrine is now generally established, and propagated by Mr. Charles Bell, in his admirable lectures on this part of the animal economy; and I believe I may venture to say, that he has generally a more accurate knowledge of these organs, and the diseases incident to them, than any physiologist who I have heard deliver a discourse on their nature.

The principal use of the crusta petrosa is, to render the upper surface of the tooth even and continuous; but being soft it gets worn down, and the enamel projects, so that alimentary matter, as I have explained, is forced in, and by continued attrition becomes firmly encrusted.

The peculiarity of the formation of the enamel renders the teeth serviceable to the exigencies of the animal furnished with them;

and did they only possess an external covering of enamel it would soon be worn down, and the bony part would then not be capable of resisting the attrition peculiar to rumination.*

The best method of viewing the three substances is, is to make a horizontal section of the tooth of an ox; and if desirous of ascertaining the hardness of the enamel, we have only to burn the cut surface and polish it.

* "As soon as the creature begins to eat solid food, "it acquires the power of ruminating. It lays hold of "the grass, &c. and pressing it with the tongue against "the roof of the mouth, and by the gums of the upper, "and teeth of the under Jaw, assisted by a twist of the "head, tears it across. After a slight mastication, the "Aliment passes into the Paunch, and from that by "small portions into the second Stomach. When a "considerable quantity has been swallowed, a morsel "is thrown back with velocity from the Stomach into "the mouth, where it is accurately ruminated, and "then carried directly to the third Stomach. This pro-"cess is continued 'till the whole of the food has un-"dergone the same operation. In the third and fourth "Stomachs a more complete digestion takes place."—Fyfe's Anatomy, vol. 4. p. 153.

OF THE

COMPARATIVE ANATOMY

OF

THE MOUTH.

No part of Comparative Anatomy presents a greater variety, or a more proper accommodation to the respective conveniences of each animal, than the different formation of their mouths. In the human species* the mouth

* " Natural historians have been at great pains to " prove from the teeth that man is not a carniverous " animal; but in this, as in many other things, they " have not been accurate in their definitions; nor have " they determined what a carniverous animal is.

" If they mean an animal that catches and kills his " prey with his teeth, and eats that flesh of the prey " just as it is killed, they are in the right; man is not " in this sense a carniverous animal, and therefore he " has not teeth like those of a Lion, and this I presume " is what they mean.

" But if their meaning were, that the human teeth " are not fitted for eating meat that has been catched, " killed, and dressed by art, in all the various ways

is flat, and fitted only for the reception of the food: but the deficiency is compensated by our being able to take what we wish to eat in our hands, and by means of them convey it to the mouth. Carnivorous animals coming under the Class of Feræ, being obliged to catch and snap at their prey, have their mouths formed in a more pointed direction, and are furnished

" that the superiority of the human mind can invent, " they are in the wrong. Indeed, from this confined " way of thinking, it would be hard to say what the " human teeth are fitted for; because by the same rea- " soning man is not a graminivorous animal, as his " teeth are not fitted for pulling vegetable food; they " are not made like those of cows or horses for exam- " ple. The light in which we ought to view this sub- " ject is, that man is a more perfect or complicated " animal than any other, and is not made like others to " come at his food by his teeth, but by his hands, di- " rected by his superior ingenuity, the teeth having " been given only for the purpose of chewing the food " in order to it's more easy digestion, and they, as well " as his other organs of digestion, are fitted for the con- " version of both animal and vegetable substances into " blood; and hence he is able to live in a much greater " variety of circumstances than any other animal, and " has more opportunities of exercising the faculties of " his mind. He ought, therefore, to be considered as a " compound, equally fitted to live upon flesh and upon " vegetables."—Hunter on the Teeth, p. 119.

with long canine teeth, by which they retain their food when caught firm between their jaws. Their molares consist of several processes of an irregular wedge-like shape, the lower ones close within the upper, and their action has been compared to that of a pair of scissors.

The formation of the teeth of the rodentia we have already explained, and this adapts their mouth to their method of feeding.

The mouths of graminivorous quadrupeds qualify them for browsing on their pastures. Their lips are full, and by means of them they collect large mouthfuls of long grass, and press it towards their teeth. Their tongue is rough, their palate corrugated, their cutting teeth project, and this enables them to bite very short grass with facility.

If we go from quadrupeds to the winged tribe, we find their mouths adapted in a similar manner to the exigencies of their distinct mode of existence. In birds, this organ is of a different nature, not having connected with it teeth and fleshy lips, like those we have before considered, but an organ serviceable to their wants, called the rostrum, or beak.

The beak consists of a hard substance, simi-

lar to horn and that which composes the hoofs and claws of animals, and it varies in shape with the habits or mode of living of different birds.—(For a further explanation of the beak of birds. See Leçons d'Anatomie Comparée de G. Cuvier, vol. 3. p. 60.)

In birds classed under the head of Passeres, such as the lark, starling, thrush, black-bird, canary, linnet, wren, nightingale, sparrow, chaffinch, and others, the bill is formed with a sharp edge and tempered point, and by this they are enabled to pick out seeds from plants, and break away the coats of grain in order to get at their internal nutritive part.

In the Accipitres, in which order come the eagle, hawk, &c. their beaks are of a hooked form, and their muscles being strong, they easily tear away the fleshy part from the bones of animals they feed upon, while holding them in the talons.

Birds living by suction, are furnished with bills as worthy to be considered as any we have noticed. They are called by Naturalists serated, or dentated bills. Their inside towards the edge is lined with parallel rows of short prickles; and these are found, though not serviceable in mastication, to be a great

source to this bird of obtaining it's nourishment. Upon making a further inquiry into these rows, they are found to form a kind of filter, and by means of them the bird is able to examine every puddle of water she comes near: and the following is the process by which this is effected.

The semifluid substances into which she plunges her bill, she draws by inspiration into the filter, or narrow interstice, formed as we have before mentioned, and the Gustatory nerves being very abundantly distributed about the mouth, any agreeable and nutritious substances in the stream are easily detected, and these she lays hold of, easily dismissing the rest.

Beautiful anatomical preparations may be made of the nerves supplying the bills of this species, and they are shewn to be very large and numerous, running down to it's extremity.

The Gustatory nerves of the snipe and woodcock are likewise exceedingly large, and pass down to the termination of the bill. These birds live on small worms found deep in soft mud, and by the length of their beak they are enabled to get at them, and detect them by means of the ample distribution of nerves.

The mouths of fishes are likewise very strikingly illustrative of wonderful mechanism, and correspond as in animals and birds, to their exigencies; but the number of their teeth varies so very much in the different species, that it would be here impossible to describe them. Their situation likewise varies in the mouth. In some fishes we find teeth only in the jaws, and in others they are situated all over the mouth; for instance, in the salmon, and cod fish.—(See Cuvier, vol. 3. p. 178.)

The jaws of sharks present to our view a very curious appearance. They contain several rows of teeth, the anterior of which are placed somewhat perpendicularly, while the posterior project backwards towards the œsophagus, and appear to be connected to the jaw by a cartilaginous substance, having no fangs to them.

The use of these teeth has been fully explained by Herissant.* He found out, that those projecting backwards were placed as a reserve in order to make good the place of any one that might be broken or injured. If we examine sharks' jaws, we seldom find the an-

* Mémoires de l'Acad. Royal. 1749.

terior row perfect, but corresponding to the broken or lost teeth, we invariably perceive one in the row behind mounting up to take the place of the former, being more or less advanced, in proportion to the time the accident has happened.

The structure of the teeth of the Lophii Piscatorii, commonly called the Sea Devil, is very admirable; they are all turned backwards towards the throat, and are united to the jaw by an elastic cartilage, yielding consequently to a slight pressure: by this means a smooth surface is presented, and the prey easily passes down the throat. This is the principal reason why the teeth are turned towards the œsophagus; but it is to be observed, that the same cause facilitating the entrance makes an exit equally difficult. The teeth of sharks, although having the same characteristic appearance, differ very materially in size and shape.

In the Raja Batis, or dog shark, they consist of several small rows of small round conical teeth, bent backwards in their middle. Those of the upper jaw are a little smaller than the ones in the upper, and it would be very difficult to distinguish them but for the

articulation of the jaws. Both in the upper and lower jaw, they are much longer towards the middle of the mouth than at the sides, and have several rows situated anteriorly as well as posteriorly. The lower jaw is perceived to be united at the symphisis by a cartilaginous substance.

In the jaws of other sharks, (viz. the Lophii Piscatorii) they consist of long teeth in the upper jaw, the posterior rows being bent backwards, and their edges all serrated. In the lower jaw the teeth are all triangular, and their edges very much serrated.

The tiger shark, which is said to be the most ferocious of the tribe, has triangular teeth both in the upper and lower jaw, and is said to have the power of collecting them when seizing it's prey. This may be well confirmed; for if we examine the attachment of the teeth, we find that it is to a bed of cartilage covering the jaw, which seems to admit of motion. The triangular teeth appear continuous with this bed of cartilage: but if we detach one of the conical teeth from it's cartilaginous gum, we find two diverging crura, about twice as thick as the tooth itself, going

off in a slanting direction, and being very firmly attached.

The tortoise or turtle, coming under the class of Reptiles, have no teeth, but instead of them a horny substance is found covering the jaw bones. The frog and toad have cartilaginous pointed substances situated in their palate, which serve as a substitute for teeth; but it is by means of their tongue that these last reptiles procure their food. In a quiescent state, the tongue is at rest and bent back; it is large, fleshy, smooth, covered with a kind of mucus, and when seizing the prey it is thrust out to a considerable distance. The chamelion, which comes under this order, has it's tongue formed in a similar manner, and it is capable of being thrust out about three inches from the mouth. The crocodile, which likewise comes under this class, has it's mouth projecting, and is furnished with long pointed teeth. These are liable to accidents, but nature has provided against the inconvenience that would by this be occasioned; their teeth are capable of renovation, and as any of them break away, others which lie immediately under them come forward and take their place.

Serpents, which come under the second order of this class, have their mouths formed with or without teeth, according to their habits, &c.*

Of the Serpents, one set move the under jaw only, another set, viz. the vipers and venomous serpents, move both jaws.

The bites of some serpents bring on almost immediate death, others a dissolution more lingering, attended by excruciating pain and anguish. Those species furnished with dog-teeth, or fangs, are said to be certainly venomous, and often poisonous, but when these are wanting, very alarming circumstances do not in general follow the bite.

* Les serpens se divisent d'abord en deux familles, ceux qui peuvent écarter les deux moitiés de la mâchoire supérieure; ils n'ont jamais d'incisives, mais ils ont des maxillaires, des palatines et des mandibulaires: et ceux qui ne peuvent point écarter ces deux moitiés, et qui, ayant tout le pourtour de la mâchoire supérieure garni de dents, ont par conséquent aussi des espèces d'incisives.

Cette second famille se reduit aux orvets et aux amphisbènes. Les orvets, outre les dents coniques un peu crochues, égales, qu'ils ont aux deux mâchoires (dix huit ou vingt en haut, et quinze au sieze en bas, de chaque côté,) en ont sur la moitié posterieure de chaque arcade palatine, de très, petites et très courtes, rangées sur deux rangs.

Dr. Russell in his Account of Serpents found on the Coast of Coramandel, describes numerous varieties of this species. He tells us, that none of those subjects are poisonous which have three rows of common teeth in the Upper Jaw, one external and two internal, the former of which he terms marginal and the two other palatal. In those where the marginal row is wanting, Fangs, or Dog-teeth are constantly found; and when this is the case, we may rest assured that all such species are poisonous.

L'autre famille se subdivise elle même en deux tribus les venimeux et les non venimeux; dans ceux ci il y a des dents coniques, crochues, tres pointues, dirigees en arrière, tout le long de chaque arcade maxillaire palatine et mandibulaire; il y en a par conséquent quatre rangées à la mâchoire superieure, et deux à la mâchoire inférieure, toutes les quatre à peu pres longitudinales.

Mais dans les venimeux il n'y a à la branche maxillaire que les dents creuses, attachées à son extrémité antérieure seulement, et par conséquent il n'y a dans la plus grande partie de la bouche que les deux rangées palatines et les deux de la mâchoire inférieure.

On sait que les dents venimenses se distinguent des autres par le canal qui les traverse, et qui donne issue à une liqueur dont nous décrirons ailleurs l'organe secrétoire.—Cuvier. Anatomie Comparée, Tom. 3. p. 173.

The similitude between the mouths of animals, birds, and fishes of prey, must be seen to be very great, and their adaptation to the exigencies of each must strike us as very remarkable.

The mouths of insects are likewise very curious; and it is remarkable also, that Caterpillars are furnished with teeth, but that Butterflies formed from them have none; the teeth are therefore cast off with the exuviæ of the grub, and a different apparatus assumes it's place.

In many insects we find the mouth with a sucker, having at the end a whimble, and sometimes a pair of forceps: by means of the penetrating form of the point, the insect is enabled to bore it's way through the integuments of it's prey, and afterwards suck out nourishment.

This is the manner in which the Oestrus, or Gad-fly, firmly fixes itself to the animal's hide, and saturates itself with it's blood.

If we examine the Mollusca, which are destitute of a real skeleton, and have no articulated members, we find in them a mouth adapted to their wants. The Cuttle-fish, which belongs to this class, is furnished with

two Jaws, each similar to horn, serving to triturate the food which the creature devours, while the Tentacula which surround the Jaws, enable it to fix itself to surrounding objects.

If we go still further, and inquire into the formation of Worms, which have neither Antennæ nor Heart, we still find mouths fitted for the reception of food. Some worms have Jaws, and others have none. The Aphrodite has four teeth and a proboscis, which it elongates and retracts at it's pleasure. The Leech has three projecting teeth of a cartilaginous nature, with sharp denticulated edges, and by means of them it pierces through the skin and afterwards extracts blood.

Comparative Anatomists further explain the formation of the mouths of Zoophytes, which are animal plants resembling vegetables. The various parts of their bodies are radiated, and the mouth is found in the centre of the Radii. The Asterias, or Star-fish has no teeth, but a round mouth,* whilst the

* The Star-fish has small spines surrounding the Mouth, and, although not properly teeth, they have been observed to lay hold of the prey.

mouth of the Echinus, or Sea Urchin, has five teeth surrounding the entry of the œsophagus, and to these muscles are said to be attached, for the purpose of enabling them to masticate the food.

From the cursory manner in which we have considered the Comparative Anatomy of the mouth, we must perceive that it presents to our view objects well worthy of our attention, and such as will amply requite any investigations we may make into it. If we view the teeth of man and animals, being unacquainted with Physiology, their appearance will present nothing more than a white inorganized polished surface, which we may most probably imagine was the work of chance; but if we make researches into Anatomy, and become acquainted with the laws of nature, and consider the Phenomena displayed in the formation, growth, and diseases of the teeth, they alone will then strike us as intricate; but going further, and reflecting even on the cursory explanation here given of the different mouths, so many wonders must present themselves, that we shall perceive that the teeth, which we before considered inorganiz-

ed, may be classed among the most wonderful productions of nature, and that the mouths of all creatures on the human globe, are most strikingly illustrative of Divine mechanism.

TABLE I.

Names.	Upper Incisors.	Lower Incisors.	Upper Canines on one side only.	Lower Canines on one side only.	Upper Molares on one side only.	Lower Molares on one side only	Total.
Bears*	6	6	1	1	5	5	36
Badger	6	6	1	1	4	5	36
Glutton	6	6	1	1	5	6	34
Coati	6	6	1	1	6	6	40
Dog, Wolf, Fox	6	6	1	1	6	7	42
Hyæna	6	6	1	1	5	4	34
Cat	6	6	1	1	3 or 4	3	28 or 30

* The first Molaris is very small, separated from the others, and near the Canine Tooth.

TABLE II.

Names.	Upper Incisors.	Lower Incisors.	Upper Canines on one side only.	Lower Canines on one side only.	Upper Molares on one side only.	Lower Molares.	Total.
Porcupine	2	2	0	0	4	4	20
Hare	2	2	0	0	5	5	24
Beaver	2	2	0	0	4	4	20
Squirrel	2	2	0	0	5	4	22
Marmot	2	2	0	0	5	4	22
Water Rat	2	0	0	2	3	3	16
Common Rat	2	2	0	0	3	3	16
Agouti	2	2	0	0	4	4	20

TABLE III.

Names.	Upper Incisors.	Lower Incisors.	Upper Canines on one side only.	Lower Canines on each side.	Upper Molares on one side only.	Lower Molares on one side only.	Total.
Jerboa	2	2	0	0	4 In that of the Cape.	4	20
Dormouse	2	2	0	0	4	4	20
Ornithorrynchus*	0	0	0	0	2	2	8
Sloth	0	0	1	1	4	3	18
Elephant	2	0	0	0	1 or 2	1or 2	
Dama	2	4	0	0	7	7	34
Hippopotamus†	4	4	1	1	6	6	

* The teeth of the *Cape Ant Eater* are composed of small tubes closed at the triturating surfaces, and when cut transversely appear like the section of a cane. The teeth of the Ornithorrynchus are formed in a similar manner.

† Sometimes we find four Molares, sometimes seven.

TABLE IV.

Names.	Upper Incisors.	Lower Incisors.	Upper Canines on one side only.	Lower Canines on one side only.	Upper Molares on one side only.	Lower Molares on one side only.	Total.
Tapir	6	6	1	1	7	7	44
Pig	6	6	1	1	7	7	44
Camel	2	6	1or2	1or2	5	5	34 or 36
Musk, Common Stags, Rein Deer	0	8	1	0	6	6	34
Other Stags, Giraffo	0	8	0	0	6	6	32
Solipedes	6	6	1	0	6	6	38
Seal	6	4	1	1	5or6	4or5	
Morso	2	0	1	0	3	3	14

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